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Light and Lighting

July 1960

Stained glass mural at the new London headquarters of Arthur Sanderson & Sons. Designed by John Piper, it is lit from behind by 400 ft. of cold cathode tubing, the light from which is diffused by opal 'Perspex' sheeting. **(See pp. 190-194.)**

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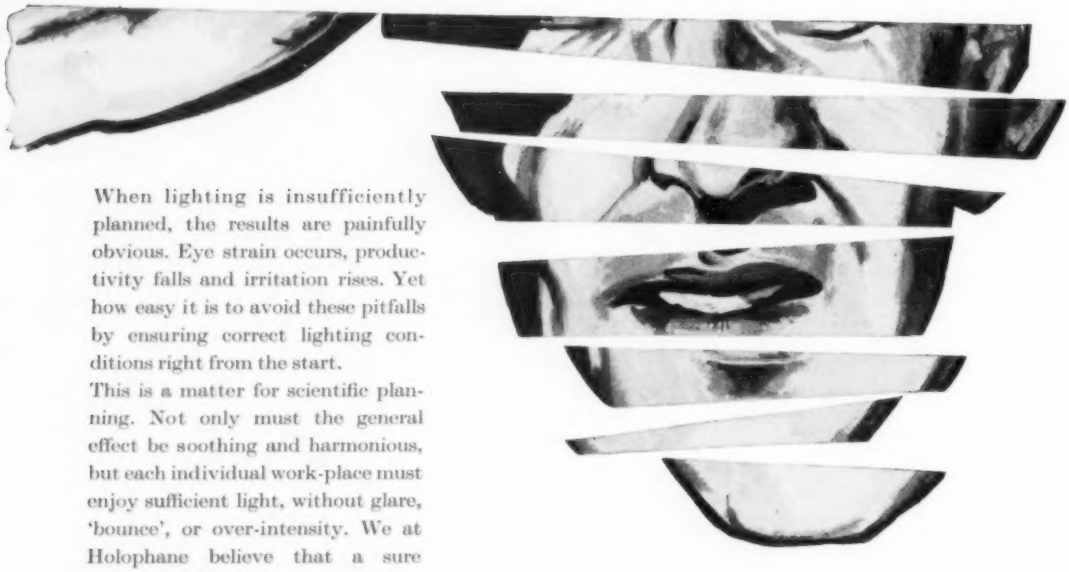

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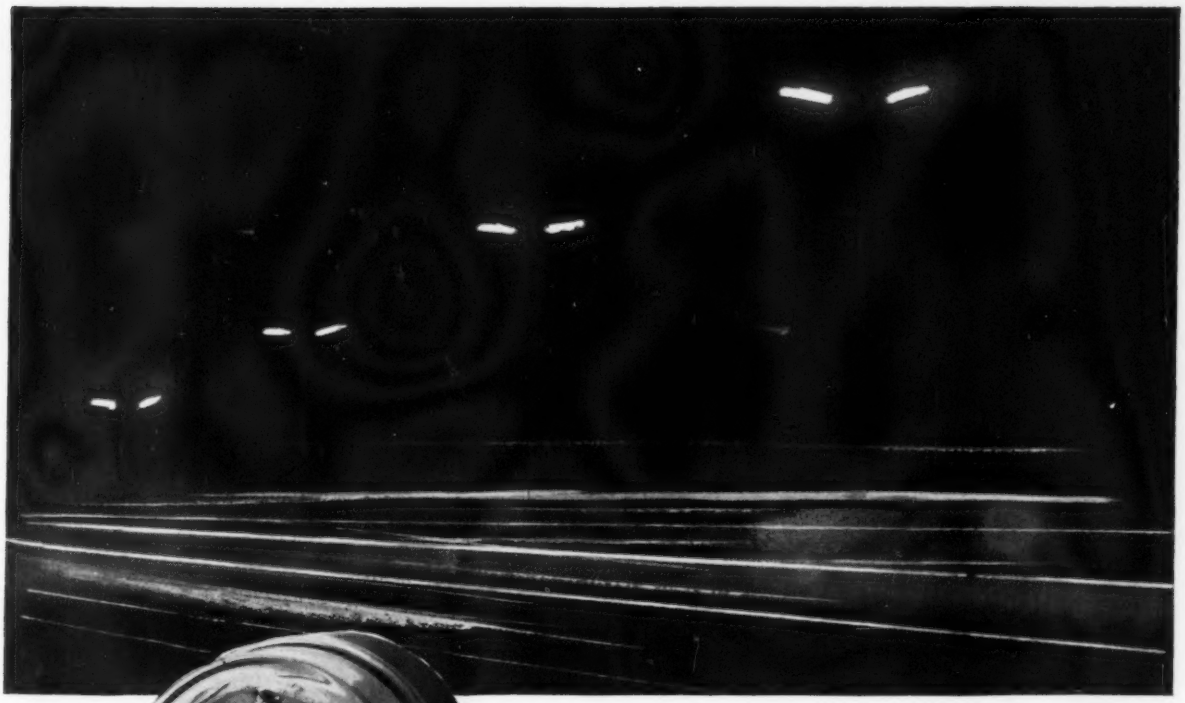

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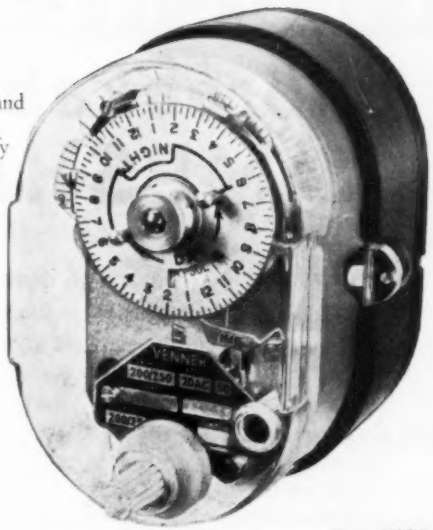

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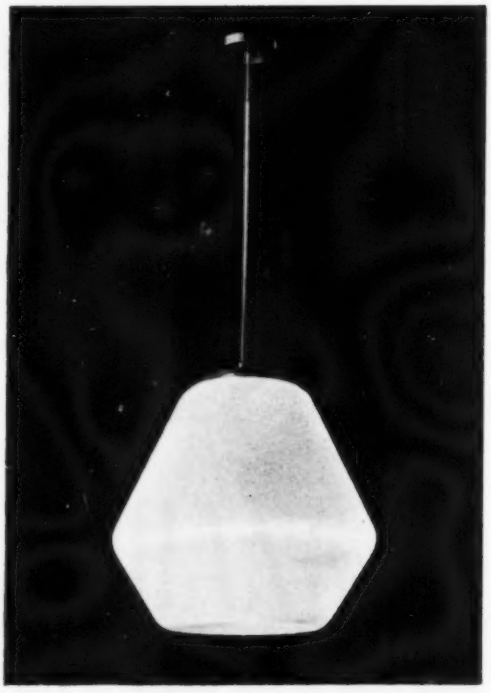

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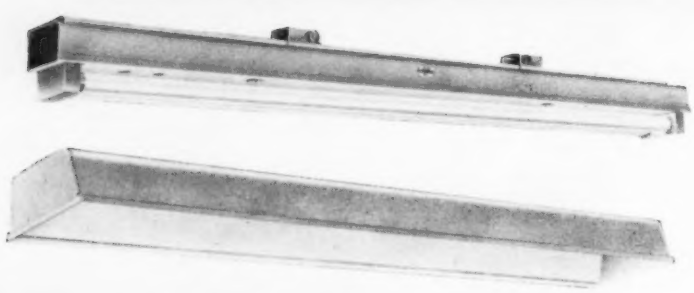
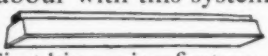
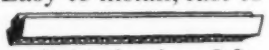


The answer, to anyone who knows the **atlas atlantic** range, is immediately obvious. Such is the saving in time and labour with this system of pre-assembled fluorescent fittings, that economies can be  effected all along the line from installation to maintenance. First big saving feature of **atlas atlantic** is the unique spring-loaded lampholder, which secures the tube all around the cap and allows one man to replace even an 8 ft. tube single-handed; and access to any part of the fitting or control gear can be obtained from one ladder position, without the need for tools or assistance. Whether **atlas atlantic** is fitted in an executive office, with one of the superb range of diffusers, or for a complete factory lighting installation using metal reflectors, the same straightforward servicing applies. Easy to install, fast to maintain, and supremely efficient  in operation, **atlas atlantic** is available in sizes 8 ft., 5 ft. and 4 ft., with single or double tubes. And so, no matter how 'special' the job you can fit the right light without 'special' cost.

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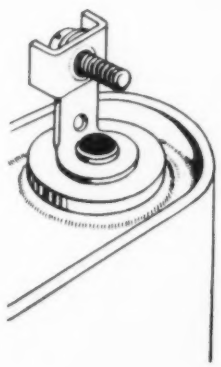

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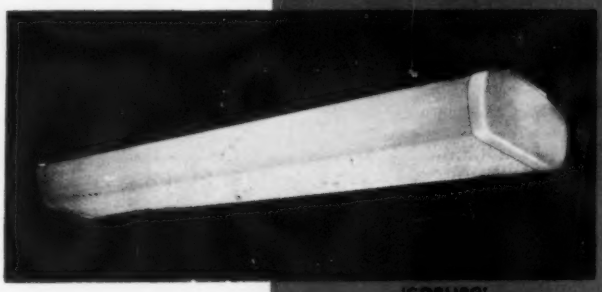

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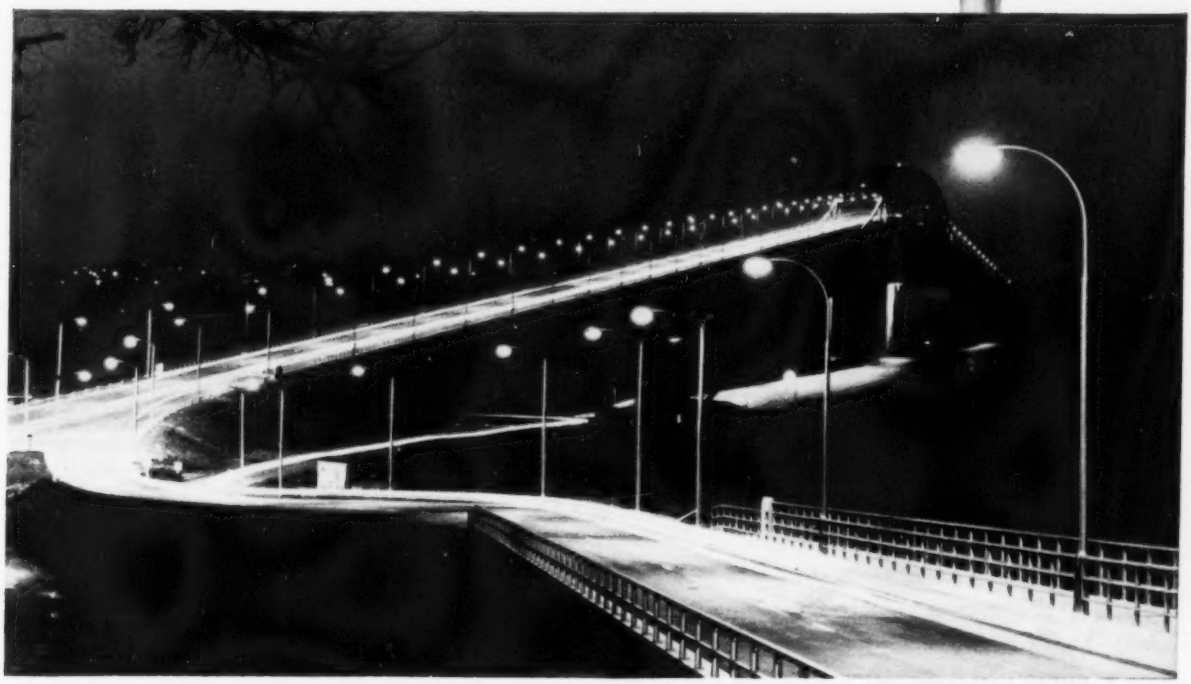

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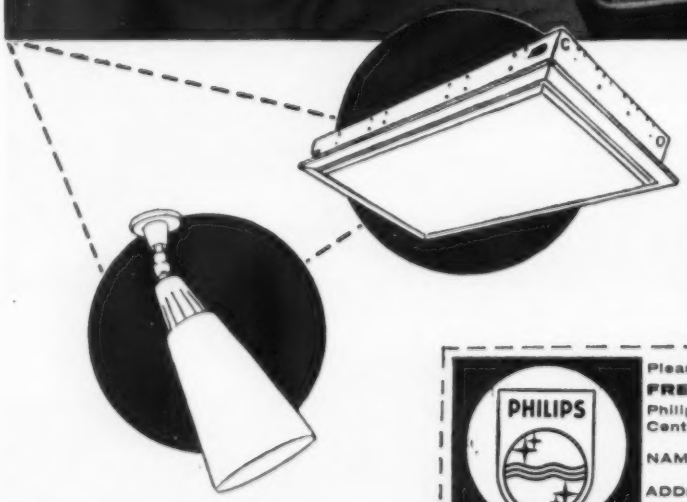

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Light and Lighting

Vol. 53 No. 7

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Published by the Illuminating Engineering Society at 32 Victoria Street, London, SW1 (ABBey 7553). Printed in England by the Shenval Press, Simson Shand Ltd, London, Hertford and Harlow. Advertisement enquiries to W. H. Bell, 43 Blandford Street, London, W1 (WELbeck 4816).

Joy thro' Lighting

IT WOULD BE easy to assemble an anthology in praise of light and lighting as engendering joy, and this is an aspect of our subject which well deserves more attention than it usually gets. 'Illuminations', of course, have been used for many centuries to heighten the enjoyment of special occasions. Their purpose is not a utilitarian one; it is not to enable us to see anything in particular except the lights themselves; it is —as Bacon put it—to rejoice the spirits of men. Floodlighting is a more recent use of light to evoke delight and its effectiveness for this purpose has been demonstrated over and over again. 'Truly the light is sweet' but, domestically, it seems to be little valued for its euphoric effect, and by no means is it always used enough even for utility. Light is relatively cheap nowadays and artificial lighting should no longer be regarded as an unwelcome domestic 'overhead'. Rather, it should be used and valued not only as the servant of 'working' sight but also as the means by which pleasurable feeling may be excited. In many homes where television receivers are afforded, 'decorative lighting' could be afforded also as an additional amenity. We do not mean by this simply dressing the 'general service' light sources in pretty 'shades'. This may achieve little except to the detriment of the general illumination. Lighting for pleasure needs to be supplementary or alternative to ordinary domestic lighting and its potentialities are, as yet, inadequately appreciated.

Notes and News

THE NATIONAL PHYSICAL LABORATORY opened its gates to a large number of visitors for two days in May, to display the usual bewildering variety of exhibits. This year's special feature was the new Ship Hydrodynamics laboratory, recently opened by HRH the Duke of Edinburgh. This is at Feltham and coaches plied between it and the main NPL buildings to enable visitors to see the new ship tank and the work being carried out in it and in the adjacent laboratories.

Much of the photometric work, especially that of routine character, is carried out in the Test House at Teddington, where there is a 15-ft. integrating sphere together with provision for life-testing lamps of all kinds. The research work of interest to members of the IES is conducted in the Photometry building and here details of several researches of fundamental importance could be seen. One study is of the direct measurement of the light from a source in energy units. This work, it is hoped, will ultimately make any primary standard of light redundant, the only requirement then being agreement on the conversion factor from watts to lumens.

Two investigations of special interest in colorimetry are those on (a) the variations of colour temperature of a coiled filament lamp with the direction in which it is viewed, and (b) the effect in colour perception which is analogous to the Stiles-Crawford effect. Just as in the latter the point in the pupil at which light enters the eye affects the apparent intensity of a beam of light, so there is a colour effect and this is being studied by Dr W. S. Stiles, and his colleague Dr J. M. Enoch. There were also some interesting exhibits of photometry at low intensity levels, using multiplier photocells with filters which give the cell a sensitivity curve very nearly the same as that of the eye in the light-adapted or in the dark-adapted condition.

Diffusers for daylighting

DAYLIGHTING IS AGAIN IN THE NEWS, attention being directed to it by a Building Research Station note (No. E999) by J. B. Collins, which summarizes a colloquium on the optical properties of partial diffusers held at DSIR headquarters last November. The colloquium was arranged to discuss the measurement, assessment and comparison of optical properties of these materials, which are neither perfectly clear nor perfectly diffusing. Opal glass, opal 'Perspex' and resin-bonded glass fibre are typical examples. Growing interest in the use of these materials for glazing has led to a demand for information on their optical and photometric properties, primarily to assist the daylighting designer.

Measurement, assessment and comparison of these properties for partial diffusers is by no means straightforward but such is the urgency of the need for at least some data that one result of the colloquium has been to call for a number of laboratory tests to be carried out under specified conditions to provide short cuts to full photometric analysis and enable a start to be made on methods of calculation. These include measurements of brightness and of light transmission of a sample when illuminated under varying conditions and measurement of integrated heat transmission with a high temperature source (a filament lamp is suggested) to simulate sunlight and a low temperature source to provide some idea of heat loss in buildings heated by warmed floors.

Rationalizing road research

THE SEEMINGLY ENDLESS RISE in traffic speeds and densities, coupled with the special problems presented by motorways and other modern traffic routes, are some of the factors which point to the desirability of large-scale facilities for practical road research. To meet this need, the Road Research Laboratory of the DSIR are to have a new road safety research track at Crowthorne, Berks, to which site the laboratory itself will eventually move in 1964.

Built at a cost of £500,000, the track is designed for research into traffic and safety measures with particular emphasis on vehicle behaviour, including high speed studies up to 80 m.p.h. It is in the form of a figure 8, giving a track length of three miles. Sections with surfaces of light and dark colours are to be used to study the effect of road surface colour on visibility with headlamps. Provision has also been made for determining the effect of various types of streetlighting on the visibility of vehicles, cyclists and pedestrians.

Physics societies' amalgamation

IN FULFILMENT OF the desire expressed by an overwhelming majority of the members of the Institute of Physics and the Physical Society—that the 'necessary action' should be taken to implement the scheme for amalgamation prepared by a joint committee of the two bodies—a new society was incorporated on May 17. To ensure that its origins are faithfully preserved, the new organization is to be known by the lengthy and uninspiring title of 'The Institute of Physics and the Physical Society'. The originating bodies are shortly to be wound up and their

assets handed over to the IPPS. The first President of the new body is Sir John Cockcroft.

New optical design studies

AN OPTICAL DESIGN GROUP is to be set up at Imperial College, London, under the direction of Dr C. G. Wynne of the Wray Optical Co Ltd. Supported by a long-term grant from DSIR, the group aims to develop new methods of lens design based on Dr Wynne's recent advances in research; it includes studies of computor techniques. Apart from Dr Wynne, the group will employ a staff of four, and will be established under Prof W. D. Wright, Professor of Technical Optics at the College's Department of Physics. Special steps are being taken to ensure that the group's results benefit British industry.

New ideas for offices

THE OFFICES BILL, which started life as a private members' bill sponsored by Richard Marsh, MP, and was later adopted by the Government, has just had its third reading in the Lords and is therefore likely to be enacted in the near future. For lighting engineers, the bill is important in that it empowers the Secretary of State to introduce regulations for the provision of sufficient and suitable lighting in every part of office premises in which persons are working or passing. What those regulations will contain in detail is, of course, impossible to say, but a number of comments have been made in the last few months indicating what they ought to contain.

One of the most recent comments came from Mr L. H. Hubble, FIES, in a paper he read to a joint meeting of the IES and the Association of Supervising Electrical Engineers. He was concerned not merely with what he considers as 'sufficient and suitable' but also with the concept of lighting as a complete amenity for offices, to which end he introduced a new design basis to simplify the implementation of new standards in the future.

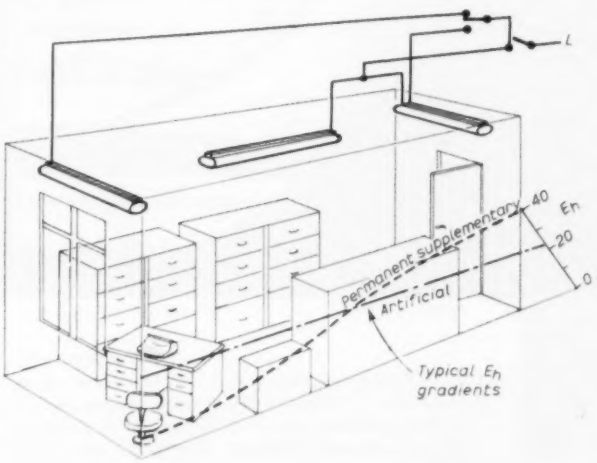
The new design basis is a three-point grid, in contrast to the usual two-point grid provided in most offices being built today. Our sketch of a typical secretary/typist office shows the arrangement suggested by Mr Hubble. It would take the place of two fittings mounted transversely in the geometric centre of each half of the office which is characteristic of today's new offices.

The rethinking which has preceded the new design system anticipates a spate of work for lighting engineers stemming from enactment of the Offices Bill. A great deal of this work, particularly for small offices, will fall largely on electrical contractors and since they will have to draw up the specification, some recognized form of presentation will both simplify their work and make their design intelligible to the client.

Specifying the amount of light required in offices is comparatively simple—a minimum of 20 lm/ft² is suggested where the visual task is no more arduous than reading fairly small dark lettering on white paper. As offices are rarely so limited in their visual tasks, higher levels are generally required; independent specifications issued by consulting engineers call for 25 to 35 lm/ft². These, however, do not take into account glare from the sky or from other sources; they are also usually based on the idea that artificial lighting is an alternative to natural lighting whereas modern thinking regards lighting as a single function, which view must ultimately prevail.

Where current two-point grid practice fails is that, with the typist's desk situated as shown (to gain maximum benefit from the daylight), the transverse arrangement of the fittings results in little artificial light falling on the paper in the typewriter. Moreover, every time the typist looks up, the furthermost fitting is in her field of view and she is likely to experience severe discomfort glare. A further disadvantage is that both fittings, being end-on to the filing cabinets and other equipment situated against the side walls of the office, present only a small projected area which is easily obscured by anyone using the equipment.

The three-point grid, in which the two transverse fittings have been moved outwards to the ends of the office and a third fitting has been mounted longitudinally at the centre, can be seen to have eliminated most of the other system's disadvantages. It also opens the way to introducing artificial lighting as a permanent supplement to daylight, by providing the fitting furthest from the window with two lamps and giving it a dual function. Both lamps would be in use during the day to supplement daylight, to give the E_h curve as shown; with suitable switching it would then become a single-lamp fitting when used with the other fittings after dark. The problem is now to devise some ready method of calculating the requirements of total lighting of offices and similar spaces, and as soon as some illumination gradient data are established, it will also be necessary to design new lighting fittings to perform these dual functions.



The floodlighting of Fountains Abbey during the IES Summer Meeting was undoubtedly one of the most impressive floodlighting installations ever carried out in this country. The picture above shows the south end of the Cellarium, which was lit by diffused light through the east windows and beams of light from the west. Some details of the installation are given in this issue; a further description will appear in a later issue.

IES Summer Meeting 1960

THE ILLUMINATING ENGINEERING SOCIETY seems now to have established quite firmly the custom of holding its Summer Meetings alternately at Eastbourne and at Harrogate. This year it was the turn of Harrogate and a large number of members and visitors, including several lighting engineers from overseas, assembled on Sunday, May 15, for three days of really concentrated technical discussion and deliberation.

The Meeting was opened by the Mayor of Harrogate on Monday at 9.45 a.m. in the Royal Hall. The President of the Society, Mr H. G. Campbell, in asking the Mayor to perform the opening ceremony, said how greatly he and the members appreciated the abundant facilities provided at the Royal Hall and the willing co-operation of the civic authorities, their officers and staff. The Society was always glad to visit Harrogate for its Summer Meeting. The Mayor, Councillor Geo. H. Holroyd, then welcomed the Society on its third visit to the town and expressed his good wishes for the success of the meetings.

Lamp Developments

THE FIRST TECHNICAL SESSION began at 10 a.m., with the presentation of a paper by Mr H. G. Jenkins of the General Electric Company Ltd on 'Progress in Electric Lamps'. Although it might appear to the uninitiated that the humble tungsten filament lamp had long ago reached finality, it was soon clear that matters were quite otherwise. First there was the perfecting of manufacturing techniques to report and improvements in capping cement which together had made possible a reduction of bulb size in several ratings without any adverse effect on life or on lumen maintenance and it appeared that further reductions would be possible if these could be tolerated by the fittings designer. An interesting side-line here was the production of a heat source which would operate at a cap temperature representing the maximum likely to be reached in the smaller size GLS lamps and which could therefore be used as a standard of reference by fittings designers and manufacturers. Then there was the introduction of different bulb shapes to meet the perpetual demand for something novel.

An important development in projector lamps was the introduction of the lamp with a built-in mirror, while a special type of projector lamp without a tungsten filament had been produced in America. In this a disc of tantalum carbide was raised to incandescence by eddy-current heating from a radio-frequency generator.

Perhaps the most interesting subject mentioned in this part of Mr Jenkins's paper was the tungsten-iodine reaction and its possible application to the general service lamp. These two elements, he said, formed a closed chemical system in which the components were continually combining and dissociating. If the bulb temperature was maintained at over 250°C the condensation of tungsten and consequent blackening of the bulb were prevented by the formation of a tungsten-iodine compound which remained vaporized. This compound did not dissociate until its temperature reached 1,600°C in the nieghbourhood of the filament, where its presence prevented evaporation of the metal and so improved the life of the lamp. The necessity for a high bulb temperature pointed to quartz as the most suitable material and for this and other reasons the lamps so far produced had been designed for special purposes.

Pioneering in fluorescent lamps

Before detailing the advances which had been made during the last few years in the perfecting of the fluorescent lamp, Mr Jenkins remarked that his house at Pinner had been lit with cold cathode and neon lamps as early as 1935 and he suggested that this might well be the first domestic fluorescent lighting installation in the world. Recent progress, he said, had been due partly to improvements in the design of the electrodes, which had lengthened the life, and partly to physical control of the fluorescent coating. The size of the particles in a phosphor varied over a wide range and by using a kind of centrifugal process it was possible to remove the very fine particles and some of the coarse ones, with the result that the luminous efficiency was considerably increased. The use of low voltage electrodes, too, had certain advantages, but there were also certain drawbacks.

After a discussion of the colour characteristics of modern lamps, the author passed on to give an account of the recent introduction of lamps with a higher loading. The life and luminous performance so far obtained with such lamps were inferior to those of the normal lamp. Other developments were the 'compact' fluorescent lamp in which the tube was bent into a grid, and the reflector lamp in which the light emission was confined to about one-third of the circumference of the tube.

In the matter of circuits the most interesting development was the use of the germanium transistor inverter for obtaining AC from a battery. A new type of semi-conductor device, the silicon controlled rectifier, was capable of handling much higher power and operating from a high DC voltage, and Mr Jenkins was optimistic that this type of semi-conductor would be developed to operate in a frequency-changer circuit giving, say, a 10,000-cyle output from a 50-cycle input. Such an arrangement, he said, might make high frequency operation a practical proposition, with consequent advantages of cheap and light-weight control gear, freedom from stroboscopic flicker and improved lamp efficiency.

Discharge lamps

In the HPMV lamp the most notable advance had been the increasing popularity of the lamp in a fluorescent coated bulb, the so-called 'colour-corrected mercury' lamp, but it seemed possible that the tungsten-

Mr H. G. Campbell, IES President.

Mr H. G. Jenkins.

ballasted lamp might be given a new lease of life by the use of the tungsten-iodine lamp referred to earlier in the paper. The pulsed HPMV lamp for cinema projection in a shutterless projector had also been introduced recently.

There were several developments to record in sodium lamps, particularly the so-called 'integral construction' in which the Dewar flask was eliminated, and the introduction of higher wattages, including a 200-watt rating in a straight tube of non-circular cross-section with longitudinal grooves at intervals. The xenon lamp, on which much pioneering work had been done in this country, had been further developed, especially in Germany. There were two types, viz. the projector lamp with the gas at high pressures, and the long arc-length lamp for general lighting. The latter was now made in large ratings, viz. 6, 10, 20 and even 65 kilowatts, although the efficiency was not much greater than that of high wattage tungsten filament lamps.

At the end of his presentation of the paper the author anticipated some criticism by saying that he had not referred to electroluminescent sources because these had been so thoroughly dealt with by P. W. Ranby and P. J. Clewer at a recent meeting of the Society.

The paper was well illustrated, not only with slides, but also with a number of demonstrations and a short film in which the behaviour during life of a tungsten-iodine lamp in a quartz bulb was compared with that of a similar lamp without iodine. A number of the lamps mentioned were shown in operation and the audience were given an opportunity of judging their colour-rendering properties.

Criticisms and a warning

After the President, who was in the chair for this session, had thanked Mr Jenkins for the most interesting way in which he had taken his audience 'behind the scenes', he called on Dr J. W. Strange to open the discussion. Dr Strange began his remarks by being somewhat severely critical, both of the reduction in the bulb sizes of tungsten lamps and of the introduction of the fluorescent lamp with low-voltage electrodes, which was interchangeable with the ordinary lamp. Both, he said, were potential sources of danger. It was now easy to put into a fitting a tungsten lamp of higher wattage than that contemplated by the designer, with the result that there was serious over-heating. With the new fluorescent lamps, too, there was the risk that one might be used as a replacement for a lamp of the ordinary type with the result that the electrodes would burn out and the lamp immediately fail. The de luxe natural lamp, he said, had had a surprising success and he thought this might be largely due to the very poor colour of the ordinary natural lamp. Finally Dr Strange remarked that he had recently been studying the life of the Society's first president, Prof Silvanus Thompson, and had been astonished to find a passage in one of his lectures, given in 1890 or 1891, where there was a clear forecast that a fluorescent lamp would be the light source of the future.

Mr H. R. Ruff pointed out the dilemma of the lamp maker in trying to achieve the most popular balance between efficiency and good colour rendering. Most people were prepared to trade some light for better colour. He said that no trouble due to sodium migration had been met with in the grooved lamp.

Dr H. H. Ballin, taking up Mr Ruff's first point, remarked that the willingness of a user to sacrifice light for colour rendering was largely governed by the conditions of use. In Germany the de luxe lamps were sold in relatively much larger numbers than in this country.

Mr B. C. Ossitt returned to the subject of overheating due to the replacement of lamps by others of higher wattage with the same bulb size, but Mr F. Widnall felt that the dangers had been exaggerated and in any case the smaller bulb had come to stay and must be accepted.

Mr Jenkins agreed with both the warnings given by Dr Strange, but the dangers of over-heating due to the use of a tungsten lamp of too high a wattage were, he felt, mainly brought about by the use of cheap and badly designed fittings. As regards the fluorescent lamp with low-voltage electrodes he pointed out that this could be used without any trouble in a circuit with a starter. Replying to a remark made by Mr R. J. Fothergill that the GLS tungsten lamp had an average life of no more than 700 hours, he referred to BS 161 and said that as all reputable makers worked to this Standard, he was at a loss to guess the basis of the figure Mr Fothergill had quoted.

Rational Basis for a Code

ON MONDAY AFTERNOON Mr H. C. Weston presented a very timely paper entitled 'Rationally Recommended Illumination Levels' in which he discussed the subject of code values of illumination in the light of recently published work, particularly in the USSR and the USA. Last year a new lighting code came into operation in the USSR, tasks being classified by size and contrast of detail to be resolved, as in the British Code. The minimum illumination prescribed was about 10 lm/ft² for rough work and the maximum about 300 lm/ft². An unusual feature was that, except at the lower end of the range, the minima laid down for tungsten lighting were half those for fluorescent, although it was stated that fluorescent should be used for preference wherever particularly good visibility was needed. The basis on which the values were arrived at was not mentioned in the Code, but in a paper published at about the same time it was stated that the different values were intended to produce, as far as possible, equal visibilities. In practice it was found that equal visibility was not achieved and this conclusion accorded with the experimentally observed fact that it was not possible, by increase of illumination alone, to give a very exacting task the same visibility as a much rougher task.

In America, however, this criterion of equal visibility had been adopted, at least as an aim. Based on Blackwell's recent work the illumination value for a particular task was intended to produce (i) visual assimilation of at least five items of information per second at (ii) a standard of accuracy of 99 per cent with (iii) a factor of 15 above threshold to allow for the gap between laboratory and field conditions. The adoption of this criterion, said the author, resulted in restrictively low prescriptions of illumination for easy tasks and impracticably high prescriptions for the most difficult tasks. In fact, for tasks measured by the Blackwell task evaluator, the levels of illumination ranged from 0·6 lm/ft² for reading 12-point type to more than 10,000 lm/ft² for seeing white chalk on tan cloth or grey stitching on

grey silk. In his latest paper Blackwell had recognized the need for a range of 'field factors' for difficult visual tasks, as well as a range of levels of visual capacity assigned on an 'intuitive basis'. Clearly the need for such procedures made nonsense of the claim that the system was more 'scientific' and yielded more rational values of illumination than other systems. In fact it seemed to the audience to make the further criticisms which followed in the paper almost superfluous.

Amenity luminance

Before dealing with the prescription of the levels of illumination needed for visual efficiency, Mr Weston devoted part of his paper to the subject of the lighting required for general well-being, the lighting needed for amenity. This amenity lighting depended largely on the environment he said. The luminance that would be agreeable in a lounge might well be lower than that suitable in a workroom. In 1945 the IES Code prescribed an illumination of 6 lm/ft² as the minimum general illumination needed to offer reasonably amenity and this figure had been retained in the 1955 edition, although higher values were stated to be desirable. There seemed to be a good deal of evidence that in fact the figure was out-dated and that a considerably higher value should be recommended. The author suggested that a luminance of 6 foot-lamberts, implying an illumination of at least 12 lm/ft², might be suitable, although in workrooms an amenity luminance of not less than 10 foot-lamberts might *well* be recommended as good practice.

Illumination at work

Turning to the illumination needed for the performance of a visual task, Mr Weston said that there were two main factors to be taken into consideration, the 'lightness' and the contrast which had to be detected. These could be combined in a single factor measured by the reciprocal of the difference between the two reflection factors involved. The use of this dual factor led to values of illumination which gave all contrasts a standard luminance difference. This, however, gave only partial compensation for degradation of contrast and in fact the current Code system of specification could be regarded either as providing fairly complete correction for the relative lightness of visual task objects and no correction at all for differences of contrast, or as providing a partial correction both for lightness and for contrast. Mr Weston then went on to propose a simplification of existing practice which meant the acceptance of the former of these alternatives as an avowed aim of the system. This simplification consisted in the elimination of the value of the contrast, as such, leaving only the apparent size of the detail and the highest reflection factor in the contrast to be taken into account. Further he suggested that the criterion should not be set in terms of a single level of relative visual performance but refer to a zone extending from about 90 to 100 per cent of maximum. A simple empirical relationship between size and standard luminance could be used in the form $\log L = 2{\cdot}25 - 1{\cdot}5 \log S$, where L was the luminance in ft-lamberts and S the size in minutes of arc. The illumination required was then found by dividing L by the reflection factor, expressed as a fraction with an arbitrary lower limit of 0·1.

The concluding section of the paper contained a warning that the illumination values found as described did not make any allowance for special conditions, such as movement of the object, or apply to a task in which the time occupied in the critical-seeing process occupied only a small fraction of the total working time.

A new IES Code

The chairman, Dr W. S. Stiles (Vice-President), in thanking Mr Weston for his very clear exposition of the subject, said that the paper was particularly topical because the IES Code was now undergoing revision by a panel of the Society's Technical Committee.

Opening the discussion, Mr J. S. McCulloch said that to him the American system of arriving at illumination levels seemed quite ludicrous, since it depended largely on the use of multiplying factors based on intuition. The panel that was revising the IES Code had accepted Mr Weston's proposals and they were now awaiting confirmation of certain features. It was not claimed that the values of illumination were derived purely scientifically; they were, however, based on scientific data interpreted with common sense. Higher standards of visual performance were justified by cheaper light and higher values of illumination followed logically.

Mr J. M. Waldram said that in lighting, as in other matters, it was 'the greatest treason to do the right thing for the wrong reason' and any changes should be justifiable on grounds that were unimpeachable. He showed by means of a series of slides how it was often difficult to analyse even the simplest task.

Mr W. Robinson said that illumination levels were not necessarily governed by the nature of the work. He mentioned the windowless factory where a constant illumination of 50 lm/ft² was needed, irrespective of the nature of the work, and the use of permanent supplementary artificial lighting where the daylight was inadequate, the illumination required depending mainly on the daylight illumination elsewhere in the room.

Mr R. L. C. Tate pointed out that luminance was less easy to measure than illumination. Moreover, architects were now 'foot-candle conscious' and to recommend values of luminance might well lead to misunderstanding.

Dr W. E. Harper, chairman of the Code panel, emphasized that the panel had very much in mind the needs of the practising lighting engineer. Illumination values were but one of a number of factors in lighting design but it was necessary, not only that they should be self-consistent, but also that they should be related to people's standards and what they demanded. The proposals in the new edition would be found to be evolutionary and not revolutionary. It has to be remembered that the user was often critical and required evidence that increased illumination led to greater productivity, less waste and a reduction of absenteeism. It might well prove that the forthcoming edition of the Code would be the last in its familiar form. What was needed for future consideration was a large-scale subjective investigation of users' requirements and preferences.

Mr J. F. Pickup made a number of suggestions as to the form of presentation of the Code which, he thought, might with advantage have a number of illustrations.

Mr Weston, replying, summed up the situation neatly by saying that science was a good furnishing for the upper stories of a house so long as there was common sense on the ground floor. For instance, if

Mr H. C. Weston.

a task was so exacting as to require an exceedingly high illumination it would probably be better to employ some optical aid. In reply to a question by Mr A. M. Marsden he said that the standard luminance at each size should be based on the assumption of a poor contrast but not the poorest contrast that might be met with. To Mr K. R. Ackerman, who supported the Russian proposal of a higher illumination for fluorescent lighting than for tungsten, Mr Weston said that he was not aware of any evidence to justify this.

Floodlighting Fountains Abbey

ON MONDAY EVENING all those attending the Summer Meeting had the opportunity of seeing Fountains Abbey as it had never been seen before. When the plans for the Meeting were at quite an early stage, someone had the idea of floodlighting these famous ruins and with the permission of Mr H. Vyner, in collaboration with the Studley Estate, this ambitious project was carried out by a number of Sustaining Members of the Society and others. At about 10 p.m., before a gathering of some 300 spectators, the President, Mr H. G. Campbell, invited the Bishop of Ripon to switch on the lighting and this ceremony was followed by a tour of inspection in which everyone present participated.

The most striking feature was the magnificent tower which was seen in the light of twenty high intensity tungsten floodlights of 1,500 watts each. Much of the other lighting was by fluorescent lamps and different colours were used in different sections, either to bring out the colour of the stonework or to create an atmosphere appropriate to a particular part of the interior.

Fluorescent tubes in green, blue and gold running along the base of the cliff on the north side of the Abbey, together with floodlighting of distant trees, created a dramatic effect; in the same way, green fluorescent lighting outside the south end of the Cellarium and Refectory silhouetted the arches to great advantage. The nave was lit by eleven twin-tube fluorescent fittings suspended vertically at high level against the wall to simulate diffused lighting through the south aisle windows. The colour of the tubes was specially selected to bring out the exquisite and varied colour of the stonework. The tower interior was lit by three tiers of vertically mounted blue fluorescent tubes and three 125-watt mercury vapour lamps to accentuate the tracery of windows and arches in the tower. The Chapel of the Nine Altars, one of the better preserved parts of the church, was dramatically illuminated by four banks of triple-tube fluorescent fittings.

As spectators were likely to leave the south door of the Chapel of the Nine Altars to proceed to the cloisters, exterior lighting in blue was provided in the open areas between the church and the north wall of the Chapter House, with added interest from the coloured lighting inside the two small chapels and the Chapter House. This feature was continued in gold along the walk to the cloisters. In the cloisters the main lighting fell on the upper part of the north and east walls. No other lighting was provided, thus directing attention to numerous artistically contrived adjacent features. Additional points of interest were the ruins of the guest houses, which used cold white fluorescent tubes, and the bridge by the west guest house which used coloured tubes directed up and down stream. Finally, the Cellarium with its shafts of light through the west windows and diffused lighting from the east, was probably the most charming sight experienced by the spectator in the course of his tour of the site.

Sustaining Members of the Society and others who collaborated to provide this unique lighting included A.E.I. Lamp & Lighting Co. Ltd., Atlas Lighting Ltd., The Benjamin Electric Ltd., Bill Switchgear Ltd., The General Electric Co. Ltd., Green & Smith Ltd., North Eastern Electricity Board, Philips Electrical Ltd.

As might be expected, there were various opinions on matters of detail, such as the suitability of the colours used in various parts of the scheme, but there were no two opinions regarding the success of the project as a whole. It is understood that the general public will have an opportunity to see the floodlit ruins during the latter part of September, when darkness comes on earlier.

Group Discussions

TUESDAY WAS THE DAY devoted to informal discussions by groups of members. Circulated with the programme of the Meeting was a sheet in which the six subjects to be discussed were listed. For each subject there was a summary of some 400 words or so, indicating very generally the ground which the discussion might be expected to cover. The meetings were held in different rooms in the Majestic Hotel and in spite of the glorious weather the attendances were remarkably high. A chairman was appointed for each meeting and two opening speakers had been warned; otherwise everything was completely informal and 'free for all'.

In the morning the subjects were (*a*) visual task analysis, (*b*) luminance and glare, and (*c*) modelling and colour. About ninety minutes of discussion was followed by a coffee break and then everyone assembled in the Conference Hall at the Hotel to hear a report from each of the three chairmen. This meeting was under the chairmanship of Mr W. F. Souter, the chairman of the Society's Technical Committee whose work was reflected in the subjects chosen for discussion.

Task analysis

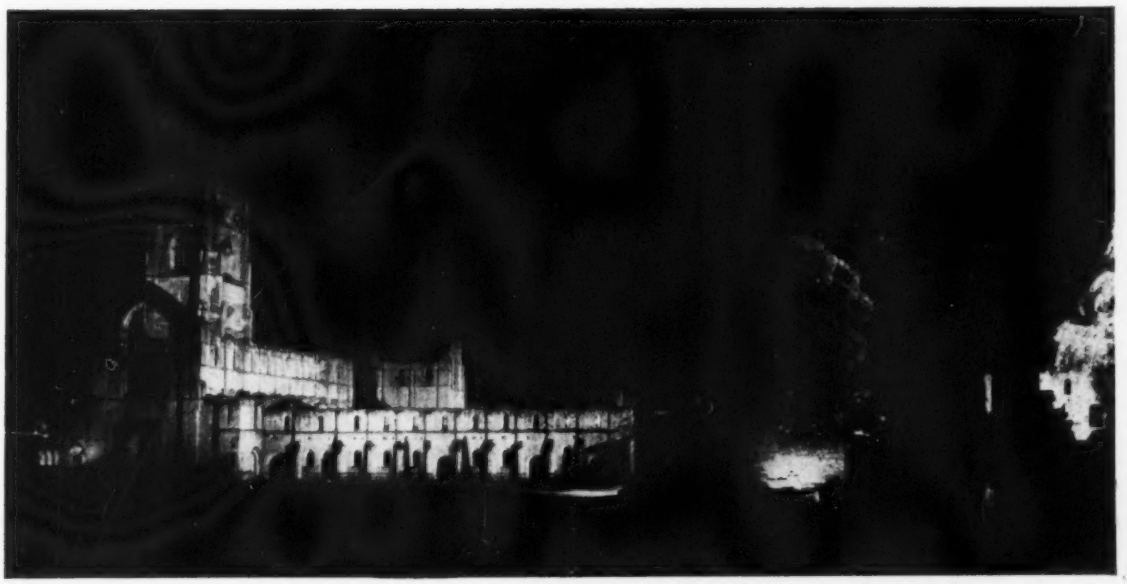
The first report was given by Dr J. W. Strange who said that one of the points made was that the practising lighting engineer was often not in a position to carry out a thorough analysis of tasks. He was largely concerned with the way in which the lighting was arranged and tended to neglect special conditions; while a more or less steriotyped scheme was carried out well, a detailed examination of the task was rarely undertaken. There were a number of pitfalls which had to be avoided in task analysis. For instance, to a typist the illumination on the keyboard was relatively unimportant; the critical seeing task was in the manuscript to be copied. At the same time the finish of the machine, often with shiny metal fittings, was an important factor in the visual field. There was a need for more flexibility in lighting schemes. Just as in domestic lighting the provision of a number of outlets was good practice, so in industrial and other lighting schemes it should be possible to make changes relatively easily. Where a task required a very high illumination, this should be provided by local lighting. Stress was laid on the importance of quality in lighting; in fact some would make illumination levels secondary to this.

Top left, Fountains Abbey.

Left, delegates and visitors at the switching-on ceremony.

Above, the Bishop of Ripon, Dr J. R. H. Moorman, switching on the floodlighting.

Below, general view of the floodlit Abbey as seen from the lawn.



Top left, Mr M. W. Peirce, who with Mr C. Passmore was responsible for the lighting of Fountains Abbey, with the Bishop of Ripon and Mr H. G. Campbell.

Top right, the Nave of the Abbey.

Left, the President with the Bishop of Ripon and Mr and Mrs Henry Vyner at the West door.

Luminance and glare

The next to report was Mr J. G. Holmes who said that in the new edition of the Code, the illumination levels recommended would be generally one step, i.e. 40 to 50 per cent, higher than those in the 1955 edition. At the same time it was very necessary that the state of adaptation of the eye should be controlled. It was now possible to specify, to calculate or to measure the glare in an installation with a tolerance which was comparable with that usual in designing for given illumination levels. One of the advantages of high illumination was its amenity value, but this was lost if glare was increased at the same time. Glare was not a function of luminance only and it was hoped that the Code would indicate permissible glare levels for different tasks carried on in different environments.

Mr Petherbridge had explained the basis of a now very widely accepted formula for assessing disability glare. This formula had been made use of in the 1955 Code, but the treatment had been so simplified that the resulting recommendations of luminance limits had not been generally applied. In the new edition there would be a table of glare indices and certain limits would be laid down for different classes of interiors. The panel responsible for this part of the Code had examined 150 lighting installations and had considered how the practising lighting engineer could apply the recommendations and carry out the necessary calculations. Among the points raised during the discussion were the form of the glare scale to be used and the need for guidance on the degree of sparkle desirable to prevent monotony in a glareless installation. It has been suggested that a study of the psychology of brightness should be undertaken, but Dr Harper had pointed out that the issue of the Code should not be delayed; it would not be a complete luminance code but would go as far as was possible at the present time. There should be no attempt to simplify the glare problem to such an extent that the results were either inaccurate or unpractical.

Modelling and colour

To conclude the morning session Mr H. R. Ruff reported on the discussion of the two distinct but related subjects of modelling and colour. A number of slides illustrating the use of colour were shown, among them several of the floodlighting at Fountains Abbey. Among the points made on the subject of colour were the importance of the duration of viewing and the dangers inherent in the use of saturated colours which could look very garish. Architects were now abandoning the use of large areas of very vivid colours in favour of pastel shades with small areas of more saturated colours for accent.

Mr Durrant had described a very interesting installation in a restaurant where brilliant lighting at the

beginning of the evening was changed imperceptibly over a period of two or three hours to a moonlight effect. He had also spoken on the subject of modelling and had advised the lighting engineer to study the photographer's use of light to achieve the modelling he wanted. A subsequent speaker had pointed out that the photographer could use as much apparatus as he liked and remove it afterwards. Further, his model was in a fixed position, whereas in an ordinary interior the modelling everywhere had to be provided by a single permanent and immovable installation. (Although this was not reported by Mr Ruff, one speaker in the discussion drew attention to what he called the 'ghastly appearance' of the officers of the Society when seated in the front of the platform at the Royal Hall with powerful lights vertically above their heads.) The hope had been expressed that the new edition of the Code would have a full treatment of the subject of atmosphere and the use of modelling and colour to create an interesting environment.

In the afternoon the subjects were (*d*) industrial area floodlighting with particular reference to railway sidings, (*e*) maintenance of lighting installations and (*f*) lighting calculations. The time-table was the same as in the morning, all groups joining after tea to hear the reports of the three chairmen.

Floodlighting railway sidings

The first report was given by Mr P. Hartill who said that the discussion had been confined mainly to one or two aspects of the subject of industrial area floodlighting as used in railway sidings and goods yards. It had been emphasized that high mounting was desirable for several reasons; it gave a relatively high illumination over a large area, it reduced glare and simplified maintenance. Even under conditions of mist or fog a high mounting was quite satisfactory.

It was most important that light should come from the right direction and for this reason the lighting engineer should have as much freedom as possible to select his sites. The maximum spacing/height ratio should be 7:1, but a lower value such as 6:1 was better. Doubts were expressed as to the validity of illumination values on the horizontal plane as a yardstick of performance and it was pointed out that the illumination of the vertical sides of railway waggons was very important. Multidirectional lighting was generally better than lighting from one direction only. For hump sidings cut-off fittings should be used. It had been suggested that a Code of Practice for the subject would be very useful but Mr Hartill pointed out that a report was now being prepared by the Technical Committee and probably this would meet the need that had been expressed.

Maintenance

The discussion on this very live subject was reported by Dr H. H. Ballin who said that speakers had urged that the matter required immediate attention from the lighting design panel of the Technical Committee. Some work on the subject had been done but there was need for much more. One difficulty frequently met with was the reluctance of the user to deal with maintenance systematically and a great deal of education and publicity was required to drive home its importance. Mr McCulloch had mentioned the ELFA publication on the design and maintenance of street lighting equipment and said that something similar was wanted for other types of lighting.

The cleaning period that ought to be adopted differed greatly according to circumstances; in many textile factories it should be short but in an air-conditioned building it might well be quite long. Group replacement, said Dr Ballin had been discussed and it had been pointed out that the cost of replacing a lamp varied enormously according to circumstances. In any installation it was the interrelation of initial and running costs that was important, not just the initial outlay.

Lighting calculations

Finally Dr R. G. Hopkinson reported on the discussion which had taken place on the subject of lighting calculations. He said that there seemed to be general satisfaction with the report of the design data panel of the Technical Committee. The Harrison-Anderson method of design and the tables based on it were becoming out-dated but they had served well over many years and anything that was to replace them would have to show a considerable improvement in order to find acceptance. Mr W. Robinson had described what would be required of fittings makers and had said that simplified method was being evolved which would give sufficiently accurate results for most purposes without involving much more labour than was required with the Harrison-Anderson method.

It had been asked why, when illumination levels were scheduled in steps of something like 50 per cent, it should be necessary to bother about an accuracy of 5 per cent in design. The answer given was that the lighting engineer often had to work to

Groups of delegates at the discussion meetings dealing with Lighting Calculations and Modelling and Colour. The lower picture shows Mr W. T. Souter, Chairman of the IES Technical Committee (speaking), and from left to right, Mr P. Hartill, Dr R. G. Hopkinson and Dr H. H. Ballin, who were chairmen of the Tuesday afternoon discussion meetings.

a specification and he had to ensure that his values did not fall below those laid down and at the same time did not exceed them so greatly that the user felt he was paying for something more than was really necessary. The key to the situation was education of those who drafted specifications to persuade them to put in realistic tolerances. Attention had been drawn to the American Society's publications describing how the measurements need to verify compliance with a specification should be made and it had been suggested that the British Code should include something of this kind.

A successful experiment

Whoever was responsible for suggesting the programme of discussion groups at Harrogate must feel satisfied with the way in which the experiment succeeded. There were expressions of satisfaction on all sides and many were the hopes expressed that something of the same kind would be arranged on future occasions.

The choice of subjects was undoubtedly responsible, at least in part, for this success. Not only were they of great interest in themsleves, but they had the added attraction of being under active consideration by the Society's Technical Committee at the present time. This gave a sense of reality, almost of urgency, to the discussions. Speakers felt that they had an opportunity to help in shaping documents which would later be issued with all the authority of the Society behind them. Conversely, members of the Technical Committee must have felt that here was a golden opportunity to find out what the generality of the membership thought about subjects on which that Committee has, in effect, the responsibility of speaking for the Society as a whole.

The Annual Dinner

ON TUESDAY EVENING THE Society's Annual Dinner and Dance was held at the Majestic Hotel, the President, Mr H. G. Campbell, being in the chair. The toast of 'The Society' was proposed by His Worship the Mayor of Harrogate in a lively speech during the course of which he entertained his listeners with a burlesque account of the trials and tribulations that beset the mayoral office. He included in the toast the President and Mrs Campbell and referred to the fact that this year, for the first time in the Society's history, its President had visited the most distant of the Local Centres, that in South Africa.

In his reply Mr Campbell said that the Society had spent two very pleasant and interesting days in Harrogate and he wanted to express their appreciation of the welcome and the hospitality that they had enjoyed. Referring to the floodlighting of Fountains Abbey, he said they were greatly indebted to Mr and Mrs Vyner for the kindness with which they had co-operated in making possible this spectacle of light and colour. He took the opportunity of thanking the Local Centres for welcoming him and his wife on many enjoyable occasions and of expressing the Society's gratitude to its Secretary, Mr G. F. Cole, and his staff for their hard work throughout the year. He concluded by referring to the honour conferred on the Society by H.R.H. the Duke of Edinburgh, who had consented to become the first Honorary Fellow.

Proposing the toast of 'The Guests', Mr C. C. Smith, immediate Past-President, said that no function of the kind could be a success without recognition by the civic authorities and they were all happy to have with them the Mayor and Mayoress of Harrogate and the Lord Mayor and Lady Mayoress of Leeds. He then went on to mention the other guests present, including Miss Helen Thompson, the daughter and biographer of Prof Silvanus Thompson, the Society's first President. Replying to the toast in excellent English, Mr L. C. Kalff said that his principal interest and study were those factors which made for agreeable seeing conditions. (Mr Kalff is chairman of the CIE Committee on this subject.) In Harrogate during the last two days there had been many things to learn in pleasant surroundings. They had had beautiful weather, beautiful lighting and many beautiful objects to look at on all sides.

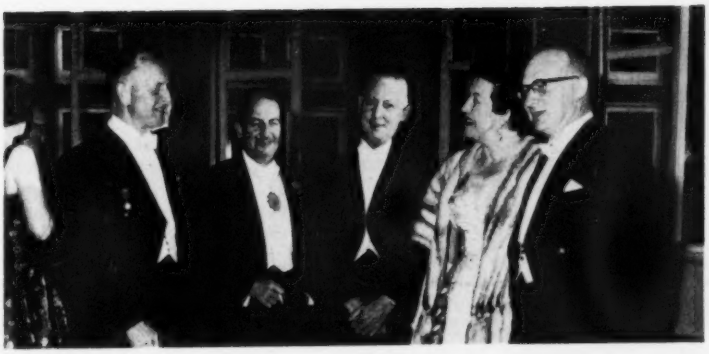
Plastics

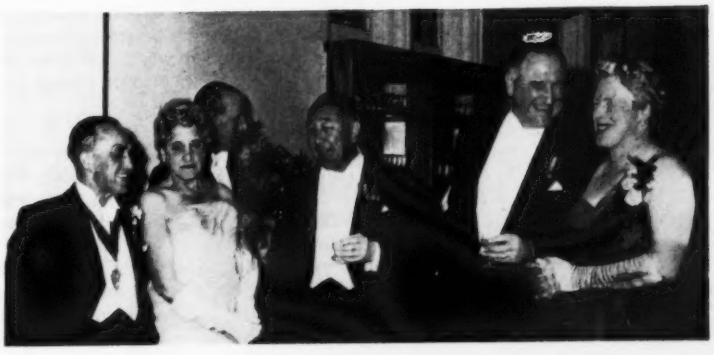
WEDNESDAY MORNING SAW THE resumption of the more conventional part of the programme, a technical meeting at which Dr C. L. Child, of Imperial Chemical Industries Ltd., presented his paper on 'Plastics, Yesterday, Today and Tomorrow'. His 'yesterday' went back to the discovery of nitrocellulose, or celluloid, in the middle of the last century and the subsequent production of cellulose acetate. Then came the birth of plastics as commonly thought of today in the familiar form of Bakelite, produced in 1907 by Baekeland. This thermo-setting resin was always dark in colour but in the mid-1920s came the urea-formaldehyde resins and, later still, the melamineformaldehyde group with no such colour limitation.

These developments firmly established the plastics industry and led to a search for new materials on a much wider front. In the late 1920s polyvinyl chloride and in the early 1930s polythene and polymethyl methacrylate made their appearance, to be followed by nylon and polytetrafluorethylene (p.t.f.e.), until at the present time there were something like a score of plastic materials in commercial production throughout the world.

The chemistry of plastic materials was based on the power of certain elements, notably carbon, to join together to form long chain molecules. Unfortunately the thermal resistance of plastics based on carbon was necessarily limited and so much research had been devoted to looking for inorganic polymers which might be expected to withstand much higher temperatures and the first commercially successful outcome was the production of the now familiar silicone plastics based on a back-bone of silicon and oxygen.

This brought Dr Child to his 'today' and he divided his treatment of modern developments under two headings of materials and processes. With regard to the former he said that none of the new materials differed in any startling way from its predecessors. Each had a certain combination of properties which made it specially suitable for some particular purpose. On the other hand there had been a more subtle advance, not so much connected with the properties of the final product as with the suitability of the constitutent powders or liquids for a particular fabrication process. For example, when p.v.c. is used to cover a cable by extrusion the best form is a fine powder, whereas when it is used to coat a fabric to produce a leather-cloth the powder used should have an altogether different particle size and shape. In fact there were in production today no less than fifteen kinds of vinyl chloride





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(1) *The President and Mrs Campbell with the Lord Mayor (Alderman Mrs Stevenson) and Lady Mayoress of Leeds.*

(2) *The President and Mrs Campbell with the Mayor (Councillor G. H. Holroyd) and Mayoress of Harrogate.*

(3) *The President and Mrs Campbell with Miss Helen Thompson, daughter of the Society's first President, Professor Silvanus P. Thompson, and Dr J. W. Strange.*

(4) *Mr E. C. Lennox, the Mayor of Harrogate, Mr T. M. Ayres (Chairman, NE Electricity Board), Mayoress of Harrogate and Dr W. E. Harper.*

(5) *Mrs Harper, Mr R. Parker (President, APLE), Mrs Parker, Dr W. S. Stiles (IES President-elect) and Mrs Stiles.*

(6) *Mr and Mrs A. H. Olson, Mrs Vyner, Mr G. F. Cole, Mr Henry Vyner, Mr and Mrs J. G. Christopher.*

(7) *Mr O. E. Robinson (President, West Yorks Society of Architects), Mrs Robinson, Mr Olson, Mr L. C. Kalff and Mrs C. C. Smith.*

polymers, all different not only in molecular weight but also in particle size, shape and size distribution.

Then there were recent developments to record in the control of the geometry of the polymer molecules. In the so-called 'block co-polymers' it was possible to form a molecule in which different segments along the length of the chain were composed wholly of one of the two components. The second development was called 'graft co-polymerization' and here a ready-formed polymer molecule, such as a rubber molecule, could have grafted on it as a branch some different polymer molecule such as polymethyl methacrylate. Both block and graft co-polymers, said Dr Child, had properties that differed not only from those of the individual polymers but also from those of the random co-polymers.

For a long time the processes used for moulding plastics were adaptations of processes long used in metallurgy or were borrowed from the rubber industry. In the last few years, however, a great deal of work had been done on the fundamental physics and engineering of the various processes employed and particular attention was now paid to the necessity for adequate and uniform heating of the material. The special technique of extrusion moulding was now being more and more widely used and the extruder was undertaking jobs previously done by injection moulding machines, by calenders, by spreading machines, by open roll mills and by internal mixers.

Applications to lighting

Dr Child devoted the final section of his paper to an all-too-short treatment of the use of plastics in lighting. Emphasizing that he was a chemist and not an engineer, he made some cogent remarks about the need for the engineer to understand his materials and appreciate both how to use them and how not to use them. He traced the growth of interest in plastics for lighting fittings from the time of the earlier fluorescent street lighting experiments and said that one of the properties of acrylic sheet which engineers were inclined to use too widely in those days was the readiness with which sections could be cemented together. Plastics technologists had had to teach them that it was better to make a shaping in one piece than to build it up from a number of separate sections. Injection moulding and extruding were now being used to produce many components which until recently were shaped from sheet. One interesting development was to extrude the polymer through a circular die to give a cylinder which was then slit by a knife and post-formed to provide almost any desired outline.

In spite of these advances in processes it was, perhaps, the production of new materials that was of the greatest interest to the lighting engineer. The two most serious limitations of present-day materials were lack of stiffness and relatively low resistance to high temperature. Today new materials with greater stiffness and higher softening points were being brought out in the forms of polypropylene and the polycarbonates. Both had a temperature resistance well in excess of that of the materials at present in use.

In conclusion Dr Child asked why lighting engineers had so far made little or no use of plastics films which were now available in so many materials.

Plastics and lighting

Mr J. G. Christopher (Chairman of the Summer Meeting Committee), who was in the chair at this meeting, thanked the lecturer for the very interesting way in which he had summarized his paper and demonstrated the properties of the materials he had described.

Dr C. L. Child (right) and his demonstrator, Mr J. B. Clark, during the presentation of the paper on plastics.

The discussion was opened by Mr F. Widnall who, in reply to the author's final query, said that the lighting engineer had, to a large extent, used plastics as substitutes for earlier materials and there were no earlier techniques involving the use of films. The lighting industry took some time to absorb new materials because the life of fittings was lengthy and there was inevitably a considerable period during which tests were used to show up the possible disadvantages of any unfamiliar product. He asked whether it was possible to apply any form of accelerated test to show, for example, the behaviour of a plastic under tropical conditions.

Mr A. G. Smith wanted more information on the thermal coefficient of expansion of plastics; this property, he said, greatly affected their workability. He had heard of a spring made of plastic and asked whether this was a possibility.

Mr G. K. Lambert enquired about the discoloration of clear plastics and Mr J. H. Morrison threw doubt on the author's statement that plastics were not attacked by acids. He had had the p.v.c. covering of a buried cable eaten away and the effect had been attributed to acids in the soil. Mr J. B. Harris pointed out that a plastic, p.v.c., was being extensively used in the from of film for luminous ceilings; the concealing power, however, was not as good as could be desired.

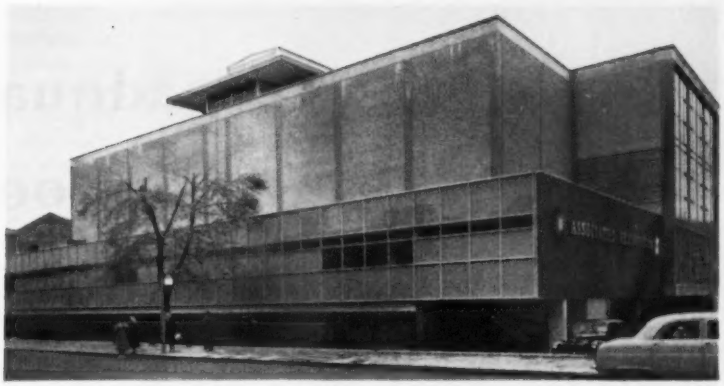
Mr B. C. Ossitt and Mr W. Goulden asked the author about the cleaning of plastic materials, with particular reference to the avoidance of a static charge, while Mr R. J. Fothergill mentioned that certain plastics, while very resistant to steady pressure, would crack under impact.

Mr D. A. Holloway asked what metals were generally employed for coating plastic films and whether polythene was affected by ultra-violet light. Mr A. Rimmer asked for more information about the transmitting and diffusing properties of plastics.

Dr W. E. Harper referred to Dr Stiles's query and

(*Continued on page* 198)

World's Largest TV Studio



Associated Rediffusion at Wembley

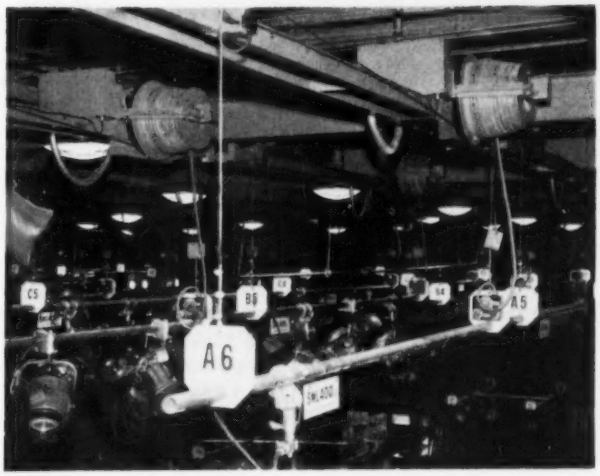
LARGEST in the world is the claim of Associated-Rediffusion Ltd for their new television studio at Wembley, which had a gala opening last month in the production of 'An Arabian Night' with a cast of 300. It was for just such large scale productions that the new studio, AR-TV's fifth at their Wembley centre, was designed; it is 140 ft by 100 ft, with an effective clear height of 40 ft. To obtain fullest use of the floor area, the studio is divisible into two separate independent half-studios, each capable of being used simultaneously. This division is effected by means of a soundproof partition, which is raised into the roof when the entire floor area is required for use.

Technical services, including lighting, are provided for each half and may be operated independently or as one when the complete studio is being used. Each half studio has 340 outlets supplied by 5 kW circuits, the majority of these being grouped together in fours on 11 ft 6 in. long suspension barrels driven by motorized hoists and cable drum assemblies.

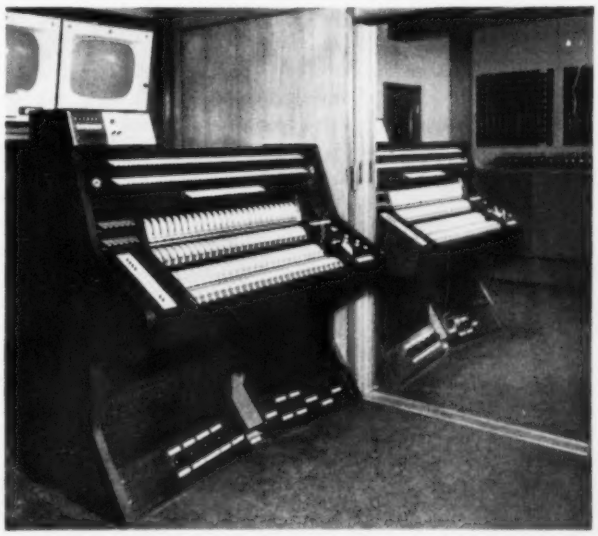
Of each group of four outlets, one is a 5 kW socket whilst the remaining three are pairs of 2 kW sockets. Each circuit is returned to an outlet in the patch panel for that half-studio's lighting control room. The panel permits the 120 control channels provided for each half-studio to be connected in series with those outlets required for any one production, of which only about one-third of the total would be normally employed. The high density of outlets and lanterns does ensure, however, that there is always a lighting unit wherever it may be required.

The lighting control units are the latest type of console-preset and employ remote servo-operated transformer dimmers. There is a console for each half-studio but these are arranged on each side of a sliding door and can be electrically linked to operate as one. The equipment gives facilities for presetting dimmer intensities two scenes in advance and for variable grouping of dimming and switching changes, whilst a memory device provides storage of up to 14 different group combinations, and when recalled, operates the components in the same manner as ordinary manual actuation.

Architects for the new studio were Farms and Partners, F/FRIBA, and the main contractors Bovis Ltd. The electrical installation and studio lighting was carried out by Strand Electric, who also supplied the control panels for the motorized hoists, made by Geo. W. King Ltd to AR-TV design.



Above is shown the motorized hoist equipment and 11½ ft suspension barrels at AR-TV's new studio at Wembley, with, on barrel in foreground, a view of the socket-outlet arrangements. Below shows the two lighting console-preset units, with patch panel in rear. The control panel to the right of each keyboard incorporates electrical linking controls to enable the two boards to operate as one.



Headquarters and Showrooms for Arthur Sanderson & Sons

Architects, Slater and Uren, F/FRIBA; interior décor and display, Beverley Pick Associates, with lighting in conjunction with the General Electric Co Ltd; main contractors, Holloway Bros (London) Ltd; electrical subcontractors, Duncan Watson (Electrical Engineers) Ltd.

THE main façade of the new headquarters of Arthur Sanderson & Sons is 230 ft. long. It has a feeling of serenity and ordered progression that accords with the English urban tradition. The materials used are cool in tone —anodised aluminium and glass, with a band of colour just above the ground floor level, where glass spandrel panels are 'flashed' sky-blue. Entrance to the building is by three different means. People arriving by car can drive straight in, through a central courtyard open to the sky, to an underground car park; chauffeur-driven visitors or people arriving by taxi can be driven into the courtyard, from which there is direct access to the lift hall (thus preventing their cars from holding up traffic in the main road); while pedestrians use a canopied entrance in Berners Street, set slightly off centre in the main façade.

The courtyard is one of the most novel and attractive features of the building. It is, in fact, the principal element of the ground floor, being 86 ft. wide and 90 ft. deep, and its central part, encircled by the roadway, has been designed as an architectural garden. At the rear, this garden terminates in a wall treated vigorously and broadly in mosaic, and against this wall is planted a group of weeping birch trees about 25 ft. high. Another feature of the garden is a long, narrow pool with a monolithic stone fountain that adds vitality and energy to the composition. (Fountain, water way and mosaics are the work of Jupp Dernbach-Mayer.)

The car park, stretching beneath the courtyard, and under most of the remainder of the building, provides space for seventy cars and is reached by separate 'in' and 'out' ramps to and from the courtyard. There is a ventilated lobby giving access to lifts that take visitors directly to the showroom and office floors.

The main (pedestrian) entrance is accented by a broad canopy that extends over the Berners Street pavement and continues into the building to meet the main passenger lifts. This canopy leads the eye towards the large stained-glass mural designed by John Piper and executed by Patrick Reyntiens. Some 32 ft. wide and 21 ft. high, this is said to be the largest example of secular stained glass ever executed. To the right of the entrance lobby is the lift-enclosing wall, treated with marble mosaic designed and executed by Dernbach-Mayer, incorporating flecks of coloured and gilt glass set at various angles to reflect the light. This wall also carries the Royal Arms, cut in slate, Sanderson's having been granted the Royal Warrant by three sovereigns, while at the foot of the staircase stands an Epstein bust of Ivan Sanderson, set on a specially-designed marble-topped table.

The main showrooms for wallpapers and fabrics are on the first and second floors. Although, for practical purposes, wallpapers are mainly on the first floor and fabrics on the second, both floors have been treated architecturally as one area, in parts the full two storeys in height. There are, moreover, many 'mixed' displays showing wallpapers and fabrics in relation to one another, including those in the two-storey exhibition hall illustrated on page 192.

Flooring in the showroom areas is of American oak, chosen for its light colour; architectural joinery is of afrormosia, polished dark grey, with panels of Japanese sen, stained and polished pearl-grey; while the main structural columns are cased either in black Kellymlunt or white Piastraccia marble. Painted surfaces have been limited to a range of colours from white to dark-grey, these neutral tones having been chosen to give full emphasis to the colours of the fabrics and wallpapers on display.

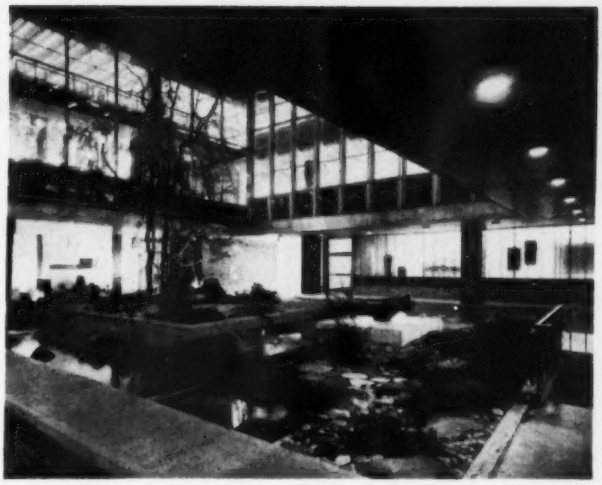
Both floors have been freely planned; particular areas, such as reception areas, being differentiated by lowered ceilings and by the lighting treatment. The recommended route through the showrooms is marked by a Cardinal red carpet strip and is defined also by the lighting, as explained below.

On the third floor of the building is yet another wallpaper showroom, for people who prefer to sit down and look through pattern books, and adjacent to this is an 'architects' room' where architects and their clients can discuss their schemes with specially trained staff in relative seclusion. On the sixth floor there is a staff dining room (for 200 people at a sitting) with an adjacent roof terrace, while other areas of these floors, together with the whole of the fourth and fifth

floors, are devoted to offices, stores and accounts departments.

The completion of the building coincides, incidentally, with Sanderson's centenary, the firm having been founded in 1860 by the grandfather of the present chairman, who began his business by importing from France fine hand-made wallpapers for the homes of the Victorian middle-classes. Sanderson's started to make their own papers in 1879 and their present factory at Perivale, recently extended at a cost of £1,000,000, employs over 1,000 people. Fabric manufacture, now an important part of the firm's activities, started in 1921 with a factory at Uxbridge with a staff of fifty.

To mark their centenary year, Sanderson's organized a wallpaper design competition, with a distinguished panel of judges, prize-winning designs having been included in their new 'Tempora' series of papers. In addition, they commissioned a number of designs for wallpapers and fabrics from several internationally famous artists and architects, including John Piper, Raymond Loewy, Frank Lloyd Wright, Arne Jacobsen and Gio Ponti.

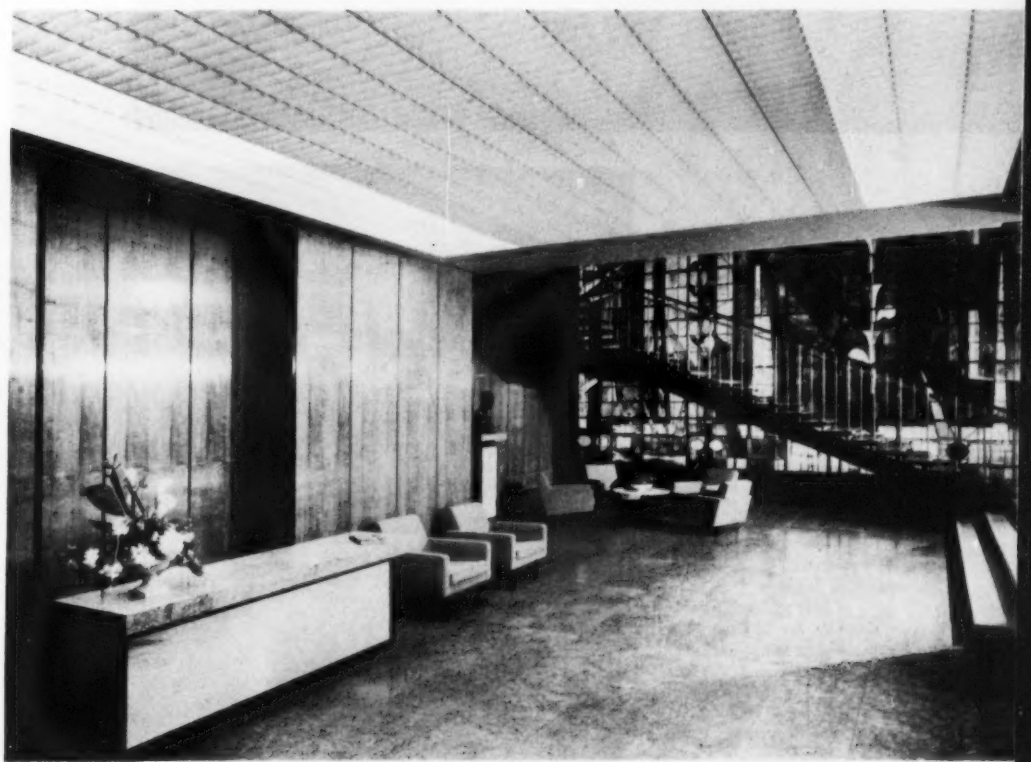


Lighting

The most notable thing about the lighting of the building is the large amount of natural light available. This is said to be a result of the great care devoted to the calculation of angles of light when the building was planned. Indeed, the basic form of the building, with its central courtyard and 110 ft tower slightly off centre, was largely determined by the aim to introduce as much natural light as possible. Excessive glare is avoided, however, by the deep window mullions that act as vertical louvres.

Artificial lighting of the public areas of the building may be considered under three headings: general lighting, display lighting and lighting that aids in emphasizing the circulation path from one showroom area to another. Display lighting was the responsibility of Mr Pick, while general lighting was the responsibility of the architects, and it will readily be appreciated that very close collaboration was needed to ensure that in each area both display and architectural lighting schemes play their respective rôles, complementing each other's effects—not detracting from them.

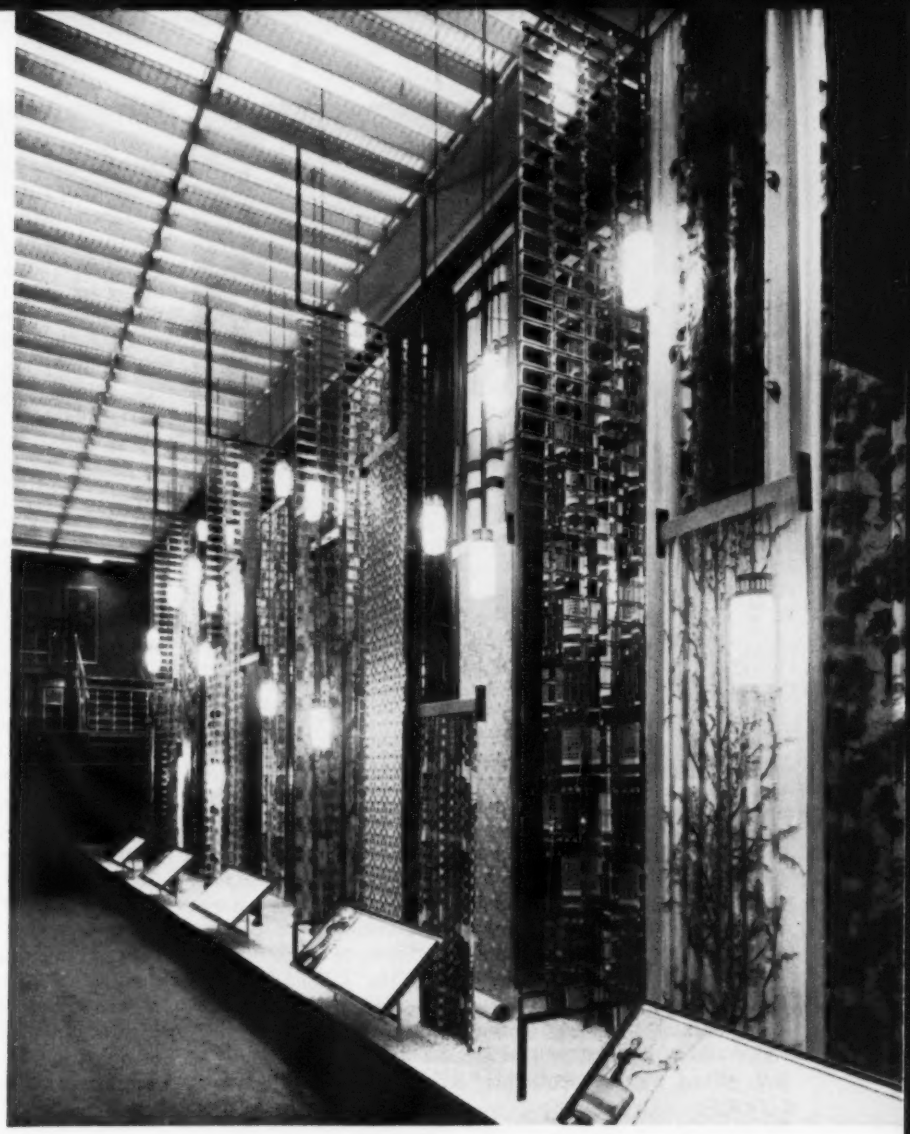
In general, lighting in circulation areas and above the passageways leading the visitor through the displays is from various forms of luminous ceiling. As the ceilings incorporate



Opposite page: the Berners Street frontage. Top, the garden courtyard, with fountain and water way floodlit, and with glass-covered downlights recessed into the soffit of the first-floor showrooms above, Right, entrance hall, with low intensity lighting from luminous ceiling, comprising warm-white cold-cathode tubing concealed by white-painted aluminium louvres arranged in both directions. Stained-glass mural by John Piper is lit from behind by 400 ft. of cold-cathode tubing, the light from which is diffused by $\frac{1}{8}$ in. panels of 'Perspex'.

Left, the two-storey exhibition hall. In the recesses of the coffered ceiling luminous panels, comprising fluorescent lamps concealed by white-painted aluminium louvres, are recessed. Over the indoor garden in the centre sixty 'Crysaline' fittings, of a new design, are suspended at various heights with white p.v.c.-covered flex. Wallpapers and fabrics are displayed on six cruciform units, each providing eight double-sided display vanes. Lighting is from 4-ft 40-watt colour-matching fluorescent lamps, each housed in a slim cylindrical reflector directing its light on to the two of the vanes. Around the periphery of this area are nine miniature room-settings, each with a 'cycloramic' vista behind. They are lit by fluorescent lamps in 'Perspex'-covered fascia units and by tungsten spotlights.

Right, part of the third-floor showroom. On the right is a small section of suspended luminous beam, with covers of reeded glass and sides of gold-anodised aluminium, providing direct lighting over the area where books of wallpaper pattern can be studied on specially-designed sloping-topped tables. In the chequerboard patterned main area of ceiling 25-watt round-bulb pearl lamps are recessed, while the free-standing displays, each in the form of four miniature room-settings, are lit from above by fluorescent lamps concealed by closely-spaced 'Perspex' louvres, and by fascia units of satin brass each housing two fluorescent lamps.



Right, part of the link area at the rear of the site connecting the northern and southern wings of the building (separated by the central court). Two storeys in height, with a gallery along one side, this area is used for special displays which, for the period following the official opening of the building, included wallpapers and fabrics designed by Fede Cheti, Frank Lloyd Wright and Gio Ponti; prize-winning designs from Sanderson's centenary competition; and a range of French fabrics that are exact replicas of historic designs, including a damask used in rooms of the Palace of Versailles. Seen clearly in this photograph are the specially designed aluminium louvres used extensively throughout the building for areas of luminous ceiling, while among the wallpapers and fabrics on display are suspended at various heights standard tungsten fittings with cylindrical opal-glass shades.

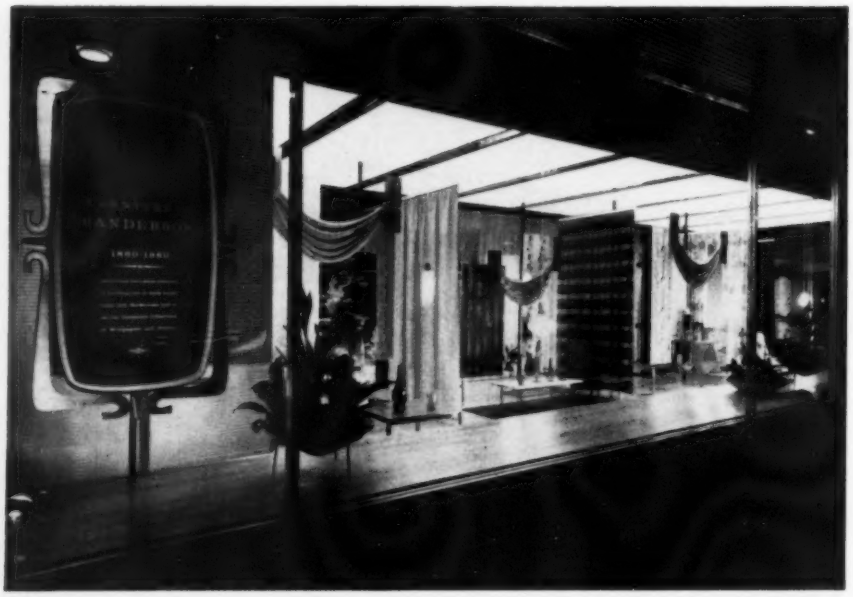
Left, part of the first-floor showroom. In the foreground is the paint-display feature comprising 75 panels each decorated in a different colour or texture. Internally-silvered spotlamps are supported by projecting arms that serve also as conduit for the wiring. Seen clearly in this photograph are the recessed tungsten fittings used throughout for general lighting. Covers are of acid-etched glass and there are perforated metal rims. Above the circulation routes, indicated by a broad strip of Cardinal red carpet, are 8 ft. 6 in. by 4 ft. suspended units, with frames of perforated aluminium, housing colour-matching fluorescent lamps concealed by plastic louvres.

a sprinkler system, the diffusing element comprises white-painted aluminium louvres. In the entrance hall, moreover, these louvres run in both directions so that the lamps above are concealed from view whether the visitor is proceeding from the entrance, towards the staircase or towards the lifts —these two routes being at right angles to one another. Window enclosures are similarly treated, the louvres here being adjustable so that strong general lighting can be provided when required or background lighting when displays are picked out by spotlights. Smaller areas of luminous ceiling—over displays, for example—comprise closely-spaced 'Perspex' louvres, while luminous soffits outside the building have 'Perspex' diffuser panels between the lamps and the aluminium louvres.

General lighting in areas where the main emphasis is on the specially lit displays is mostly from tungsten downlights, partly recessed into the suspended ceilings. Various types of fitting are used, most with covers of etched glass and decorative rims of perforated metal. The garden courtyard is floodlit and includes under-water lighting, and for the driveways to the garage there are special glare-free unidirectional fittings housing tungsten lamps.

The entrance hall is lit to a relatively low intensity by warm-white cold-cathode tubing above aluminium louvres, as described above, the stained-glass mural being lit from behind, also by cold-cathode tubing, giving the effect of daylight shining through. Each section of the mural is backed by an $\frac{1}{8}$ in. 'Perspex' panel for light diffusion and extra strength. In all, some 400 ft. of tubing has been installed, most of this set back some 18 in. behind the mural surface and mounted on a framework of 'Dexion' slotted angle. Where structural beams occur, however, the space behind the mural is considerably reduced, so that the tubes lie only 8 in. or so behind its surface. To maintain uniform luminance of the mural under such conditions, an additional sheet of opal 'Perspex' has been placed over the beam-mounted tubes. A further means to maintaining uniformity has also been obtained by running the tubes at different currents.

In display areas lighting is mainly from colour-matching fluorescent lamps, Sanderson's having found that these give the best colour rendering for their products, together with tungsten fittings mainly for decorative effect. The lighting units themselves take various forms, one of the most dramatic being a luminous beam in the wallpaper showroom no less than 123 ft. long, while decorative arrangements include a cluster of over sixty 'Crysaline' fittings suspended at various heights in the two-storey exhibition hall and staggered rows of miniature lamps recessed, with aluminium reflectors, into the suspended ceiling over the entire first-floor showroom.



Top, close-up of typical display unit, lit by 'ceiling' of closely-spaced plastics louvres concealing colour-matching fluorescent lamps, and by internally-silvered tungsten spotlamps (some shining upwards, some downwards), their lamp-holders covered by matt-black cylindrical metal sleeves. Right, typical window display area, with luminous ceiling fitted with aluminium louvres adjustable so that, when displays are lit mainly by spotlamps, general lighting can be cut down to background intensity.

LIGHTING ABSTRACTS

OPTICS AND PHOTOMETRY

847. Comparison of visibility measurement systems. 612.843.6
A. A. EASTMAN and S. K. GUTH, *Illum. Engng.*, **55**, 176-181 (*March* 1960).

Visibility measurements with the Luckiesh-Moss visibility meter and, more recently, with Blackwell's visual task evaluator have each been used to specify recommended illumination levels. Measurements on a series of 'standard' visual tasks have now been made with both instruments in order to compare the illumination levels required for these tasks. Discrepancies between the two sets of values can be attributed to the different instrument viewing conditions, differences in the wedges used in the instruments and the fact that Blackwell's procedure, unlike the Luckiesh-Moss meter, takes into account the speed of performing the task. P. P.

612.843.3

848. The influence of the colour of light on the threshold values of vision.
A. A. KRUITHOF, *Ljuskultur*, **32**, 15-19, No. 1 (*Jan.-March* 1960). *In Swedish.*

In addition to the subjective preference for 'cold' coloured lamps at high values of illumination, and of 'warm' coloured lamps at low, an effect of lamp colour on threshold visual acuity has also been found. This effect is negligible below 10 candelas/metre^2, but above 30 candelas/metre^2 sharpest vision occurs with low colour-temperature light. R. G. H.

LAMPS AND FITTINGS

621.327.4

849. Mercury lamp with internal cut-out for trouble-free straight series circuits.
W. C. MATZ, *Illum. Engng.*, **55**, 187-189 (*March* 1960).

Operation of mercury vapour lamps in series circuits from constant-current transformers has advantages provided the circuits can be maintained in the event of lamp failure. Film cut-outs have been used for this purpose, but have proved unreliable in that short-term transients have caused the cut-outs to operate although the lamps were sound. A new cut-out which obviates false failures has now been developed. This is built into the base of the lamp and operates by fusing together the lead-in wires. P. P.

621.329

850. Reflector fittings for efficient directing and screening of light from fluorescent tubes.
G. HASSEL, *Ljuskultur*, **32**, 68-69, No. 2 (*April-June* 1960). *In Swedish.*

The design of elliptical reflectors for use with fluorescent tubes is discussed, and the suitability is pointed out of fittings incorporating such reflectors for street lighting and for office lighting when the units are mounted above the window head. R. G. H.

851. Zirconium flash lamps. 621.327.9
H. BERGHOLTZ, *Ljuskultur*, **32**, 35-36, No. 1 (*Jan.-March* 1960). *In Swedish.*

Very small photographic flash lamps of very thin zirconium strip-foil permit close optical control of the light with very small reflectors. Closer control of colour temperature, and less liability to premature firing are also possible. R. G. H.

LIGHTING

628.971.6

852. Relative visual comfort evaluations of roadway lighting.
C. H. REX and J. S. FRANKLIN, *Illum. Engng.*, **55**, 161-172 (*March* 1960).

The Guth glare evaluator (Abs. No. 745) has been used in a car on the test streetlighting installation at Hendersonville, North Carolina, to determine the BCD evaluations of eleven observers under night-time conditions. These evaluations have been compared with computed ratings determined by a method developed by one of the authors (Abs. No. 742). Separate BCD evaluations from a team of 52 observers were determined under laboratory conditions to give a more reliable measure of 'population' glare sensitivities. Correlation tests between the BCD evaluations and age and latitude of birth of the observers were made, but the findings were not statistically significant. P. P.

853. Versatile lighting system for highway tunnels. 628.971
H. SKOOTSKY and J. R. BRASS, *Illum. Engng.*, **55**, 147-154 (*March* 1960).

The problems of tunnel lighting are considered, particularly those related to the daytime lighting of tunnel entrances. Tests have shown that a lower-wall luminance of 60 foot-lamberts over a 300 ft. long entrance zone is required for clear silhouetting of vehicles when the entering speed is 55 mph. and the daytime wall luminance in the central zone is 5 foot-lamberts. Night-time wall luminances in the entrance and central zones of $\frac{1}{2}$ foot-lambert are normally adequate. Design objectives for satisfactory tunnel lighting are listed, and their achievement in terms of the correct choice of lamp, power supply system, ballast and luminaire are detailed. P. P.

854. Lighting in departments stores and shops. 628.972
B. EDLUND, *Ljuskultur*, **32**, 79-82, No. 2 (*April-June* 1960). *In Swedish.*

Modern shop architecture aims at a luxurious and stimulating environment for selling. The use of large areas of glass minimises the barrier between outside and indoors. The artificial lighting must appear to project the goods through this remaining barrier. The level of interior light must be sufficient to combat outdoor glare and adaptation. Entrances must have a very high level by day, but at night this level can well be reduced. R. G. H.

628.977

855. Lighting in control and machine rooms in Stornorrfors power station.
K. O. HEDIN, *Ljuskultur*, **32**, 65-66, No. 2 (*April-June* 1960). *In Swedish.*

The lighting of the underground rooms of a hydro-electric power station is described with cross-sectional illustrations. Three-phase fluorescent tube lighting in five ceiling-mounted rows provides the main illumination of the control board. The ceiling is graded in brightness by means of selected grays between the rows, in order to reduce glare. R. G. H.

856. The purpose of ecclesiastical architecture. 628.978
J. OLIVEGREN, *Arkitektur*, **59**, 240-242, No. 11 (1959) *In Swedish.*

No clear aim can be discerned in modern Swedish church architecture, which sometimes appears to express Valhalla rather than Christianity. Light should be the building stone of a church. The church is too often confused with the theatre, with a lit-up altar to be looked at. In a church the light should embrace everyone and fill the whole space. Failure to appreciate the role of light is the basis of failure in modern church architecture. R. G. H.

857. Light and road safety. 628.971.6
SIR WILLIAM GLANVILLE, *Trans. Illum. Eng. Soc. (London)*, **25**, 69-85 (No. 2, 1960).

The importance of improved seeing when driving at night has been demonstrated by analyses of road accidents occurring in daylight and darkness. The work of the Road Research Laboratory concerned with light and road safety has therefore a humanitarian basis. Among the aspects of the subject studied at the Laboratory are the reflection characteristics of road surfaces and their relation to associated skidding characteristics, the re-design and re-siting of street lights to operate successfully in conjunction with present-day road surfaces, the effect on injury accidents of improved street lighting, the performance of car headlights, giving particular attention to the meeting beams, and the influence of yellow versus white headlight beams on seeing ability. P. P.

628.924

858. Quick and easy determination of the window dimensions needed for lighting.
E. HOCHSTADT. *Lichttechnik*, **12**, 297-299 (*May* 1960). *In German.*

The size and shape of window needed to give a specified daylight factor in a room of given dimensions can be found from two simple graphs. One of these gives the ratio of window area to floor area for any angle of elevation (α) of the external obstructions; the other gives the height of the window for different values of α and of the depth of the room. For the second graph three alternatives are given, applicable respectively to dwelling rooms, industrial premises and schoolrooms. The area found is that of the glass; an allowance of 10% has been made for loss in transmission and another 10% for loss due to dirt. J. W. T. W.

Fig. 1, general view of the fountain on the Schwarzenbergplatz

High-jet fountain in Vienna

By H. Ruzicka

THE high-jet fountain on the Schwarzenbergplatz has long been one of the sights of Vienna. Both citizens of the city and visitors from abroad take pleasure in watching the rise and fall of the water and the changing play of light in the various colours of this axially-symmetrical illuminated fountain.

In the year 1873, at the request of Antonio Gabrielli, the sum of 200,000 kronen was set aside as a foundation gift towards the provision of a monumental fountain, this sum being part of the prize money awarded to Gabrielli for the construction of the first Viennese piped-water system. The first fountain was a temporary one, and not until June 23, 1905, after basic alterations and extensions had been made to the plant, including the addition of a lighting system, was the fountain again put into commission.

In 1958-59 the old lighting plant, which had deteriorated during the war and was uneconomic in operation, was rebuilt according to modern knowledge and was started up again in its new form on May 30, 1959, at the beginning of the Vienna Festival Week.

The original fountain, in its 40-m.-diameter circular basin, consists of a middle group; six so-called 'royal castles' grouped around it in a circle; and 365 small nozzles around the circumference of the basin directing their arc jets towards the centre. The main group of nozzles in the centre, known as 'The Emperor's castle', consists of a main jet from a 55-mm-diameter nozzle, which should theoretically attain a height of about 40 m., but which must be restricted to about 20 m. because of the strong wind generally prevailing in Vienna. Around this main jet there are grouped, firstly, three, then twelve, twenty-four and, finally, thirty outer nozzles for jets that fall away outwards when their reach their highest points. A circular group of rocks prevents the conduits and nozzles, etc., from being seen.

The well chamber is situated beneath the main jet group. It has a diameter of over 8 m. and six passages radiate from it towards the 'royal castles'. In the ceilings of these passages there are cylindrical light shafts with a diameter of about 1 m., rising above the normal basin water level and sealed with mirror glass. There are twenty-one shafts for the main jet group and one for each of the 'royal castles'.

The lighting installation, before being rebuilt, comprised, for the illumination of the middle group, nine 60-amp and twelve 40-amp carbon-arc lamps, the former with 80-cm. and the latter with 60-cm. reflectors. For the 'royal castles' six 40-amp carbon-arc lamps were used, while coloured discs, motor-driven and mounted between the lamps and the apertures, produced varied colour effects. The marginal jets were illuminated by ninety 60-watt lamps in watertight fittings mounted near the nozzles.

The need to change from direct to alternating current provided the stimulus to alter the old-fashioned installation radically, to operate it more economically and simplify its working, so that the high-jet fountain, which was allowed to play only on festive occasions, can now give pleasure to the public more frequently and for longer periods, yet requiring less personnel to operate it, In the past, the water required—some 1,000 m^3 per working hour—had to be taken from the normal water mains. Today, circulating pumps, taking a load of 80 kW, take the water from the basin, lead it into three built-in filters housed in three central light shafts, now left open, and deliver it to the water jets through 441 nozzles.

The new illumination system, selected by the City Engineers' Office of the Vienna Municipality after extensive tests, is based on the use of Philips' pressed-glass 150-watt, 220-volt reflector lamps. The lamps are weather-resistant and, to produce a complete fitting, require only a watertight holder, with a waterproof cable inlet, and a sleeve to cover the joint. The holder used—a Philips' fitting—can be swivelled and has a silicon/rubber washer.

A total of 1,524 of these spotlamps are used, 804 of them in the

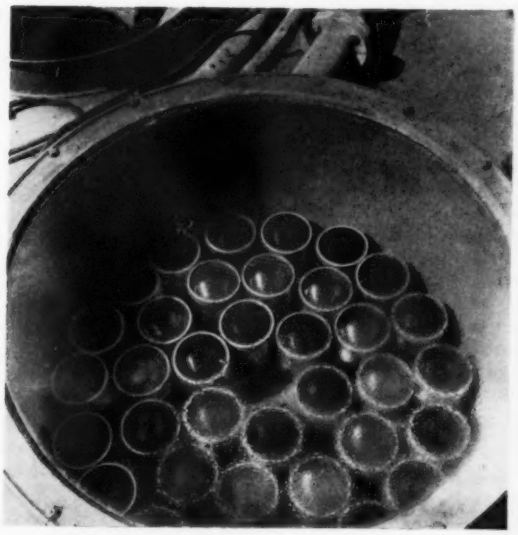
well chamber, below the cylindrical light shafts. The other 720 are fitted on eighteen rectangular frames in groups each of forty fittings, the frames being arranged in segments around the inner edge of the main jet basin, which is surrounded by rock. The first group of lamps lights the central axis of 'The Emperors' castle', while the second group mainly illuminates the upper half of the jets, as well as providing extra general lighting for the main fountain.

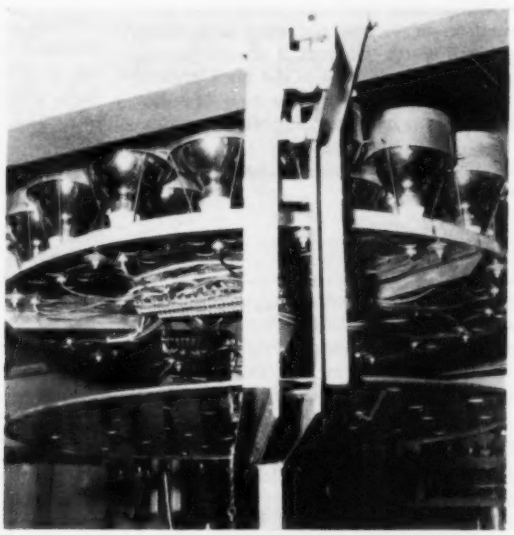
To continue the tradition of coloured illumination, coloured filters have been fitted to the light sources. The largest number of lamps are fitted with blue filters, while green, red, yellow and white filters are less numerous—in that order.

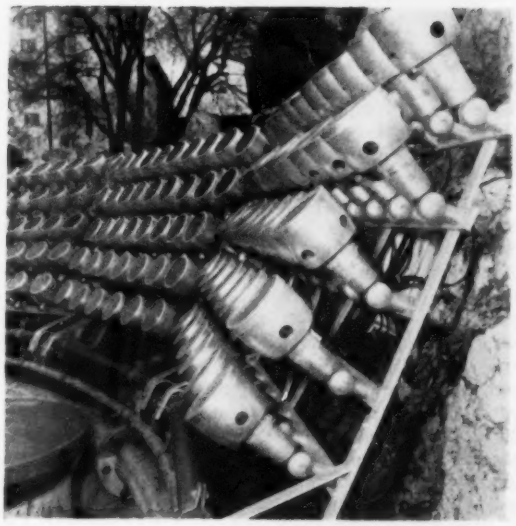
For the main jet group, under each of the eighteen light shaft openings (see Figs. 2 and 3) there are thirty-six coloured spotlamps mounted on a disc-shaped, perforated metal plate. Each of these inner floodlight units can be lowered and raised to facilitate lamp replacement. Similar floodlighting units are to be found under the 'royal castles', these each comprising twenty-six coloured lamp units. Then there are eighteen floodlight units above ground level, around the perimeter (see Figs. 4 and 5), each comprising forty lamps. The lighting of the circumference jets has remained unchanged, and ninety 60-watt lamps in waterproof fittings placed around the edge of the basin serve this purpose.

Thus, there is a total of 1,524 150-watt lamps and ninety 60-watt lamps, giving a total loading of 234kW, though only a certain proportion of the lamps are switched on at any one time. The switching on of the illuminations (by connection to the low-tension side of the high-tension transformer) is effected by a switch unit in the well chamber. This comprises a six-part switchboard containing switching and cut-out elements for the pump, ventilation and illumination plant. The spotlamps are controlled in groups and can readily be switched on and off by means of keys, pilot circuits and air switches. A time-switch and plant for the automatic changing of the colours is to be built-in, so that eventually there will be fully-automatic illumination in both pure and mixed colours according to a pre-arranged programme.

The extent of the switch plant will be appreciated when it is explained that there are 172 air switches, 390 cut-outs, 230 control lamps and 310 keys, as well as nineteen ammeters and three transformers. There is an illuminated switch diagram above the control desk and various safety devices are incorporated in the installation.







2 | 3
4 | 5

MISCELLANY

Book Review

'Basic Technical Electricity' by H. Cotton, M.B.E., D.Sc. Published by the Cleaver-Hume Press, London, 1960. Pp. 246 with 68 figs. and 12 half-tones. Price 12s. 6d.

This is the third edition of a book well-known as a useful aid to the student of electrical engineering. It is the first of a series of ten volumes, under the general editorship of Prof Cotton, and deals with the more fundamental aspects of the subject, the other volumes (one on Electric Lighting) covering different branches in more detail. This edition had been extensively revised; in particular the M.K.S. (metre-kilogram-second) system of units is used throughout, as recommended by the Institution of Electrical Engineers. As might be expected from the author, the treatment is sound, clear and very readable, a combination of virtues not easy to achieve, but well worth the work it always necessitates. The production of the book is satisfactory, though the paper used does not do justice to the half-tones, rather surprisingly since, for a small book ($7\frac{1}{4} \times 4\frac{3}{4}$ in.), the price cannot be considered low.

J. W. T. W.

Personal

THE RIGHT HON THE EARL OF VERULAM has accepted the invitation of the Association of Supervising Electrical Engineers to become their President next October, when Sir Josiah Eccles vacates the appointment, which he has held for two years. Lord Verulam is Chairman of Enfield Rolling Mills Ltd, Engineering & Lighting Equipment Co Ltd and Sternol Ltd.

Philips Electrical Ltd announce a number of new appointments. In the South-East Region, R. C. MERCER is to be manager of their Regional Street Lighting Department. He is succeeded as area manager for Surrey, Sussex, Hampshire, Berkshire and London SW by MR R. PITTEWAY. MR D. I. CAMPBELL, B.SC(ECON) is to be lamp and lighting representative for Bedfordshire, Cambridgeshire and Huntingdonshire in place of Mr Langworthy whose retirement was announced recently. In their Midlands Region, Philips have appointed MR H. B. KNIGHT as lamp and lighting representative attached to the Nottingham Branch. MR H. G. MAXWELL has joined the Belfast Branch as a junior lighting engineer.

Industrial Notes

FACTORS TO BE TAKEN into account when planning industrial installations are set out in 'Industrial Lighting', a guide for users published recently by the British Lighting Council. It starts by showing how ability to work depends upon ability to see, which in turn hinges upon the proper matching of the type and method of lighting to the visual task. Mention is also made of the psychological benefits of employing to provide bright surroundings. Cost is discussed in relation to output, spoilage, labour turnover and other factors of continuing concern to factory managements. Figures are quoted for a number of cases representative of factory experience and government investigations to show the extent to which improved lighting has led to increased production. Although it would have been impossible in a publication of this size to analyse detailed lighting requirements of individual industries or processes, a number of special lighting applications are described. These include dealing with polished or matt surfaces, inspection by fluorescence or by silhouette, colour matching and grading, use of polarized light and lighting in hazardous areas. The booklet costs 5*s.* from the BLC, 16-18 Lancaster Place, W.C.2.

TO CATER FOR INCREASED DEMAND for their products, Lumitron Ltd have recently acquired additional premises of some 25,000 sq. ft. in Willesden. The increased space available will permit larger stocks to be held and should result in an improved London van delivery service. For convenience of customers in the area, a trade counter is to be opened where, apart from their normal range of fittings, control gear and tubes will also be available for collection and delivery. Lumitron's premises at 180 Shaftesbury Avenue, W.C.2, will continue to operate as their main showrooms with trade counter facilities for clients in the West end.

A REVISION OF B.S. 1522, *Schedule for projector lamps*, specifies technical details for five classes of lamp; A1, for film projection, slide viewing, etc; B1, (round bulb), and B2, for floodlighting; F, for microprojection; T, theatre spotlighting. The standard merely covers lamps in general demand, a completely comprehensive specification being obviously impracticable. It specifies dimensions, ratings and objective average life values to assist the designer and direct his attention to these more popular types. Class E (epidiascope), Class G (exciter) and Class S (studio) lamps have been excluded, the latter two being now covered by B.S. 1015 and B.S. 1075 respectively. It is hoped to include general data for filament dimensions in a future issue. Copies of the standard can be had from the BSI Sales Branch, 2 Park Street, W.1, price 4*s.* 6*d.*

OSRAM HAVE NOW EXTENDED the use of 60 mm bulbs to 75 W and 100 W lamps to complete the standardization on this bulb size for all their pearl and clear coiled coil lamps. Bulb and cap temperatures are stated to be very similar to those of single coil lamps in 68 mm bulbs.

THE FIRST MAJOR commercial building to be projected in Glasgow since before the war is to be occupied by Philips Electrical Ltd as their new Scottish Region headquarters; they expect to take possession towards the end of the year. Now under construction in the centre of the city, the new building is a seven-floor tower rising above larger-area ground and first floors at the corner of Waterloo and West Campbell Streets, 100 yards from their present showrooms.

IES Summer Meeting—*continued from page 188*

pointed out that the particles in a translucent plastic were not formed within the material but were added, so that any control had to be applied to the powder used. He mentioned that Dr Child was on the Council of the Plastics Institute and suggested that the IES should approach that body with the object of arranging a joint discussion of problems of common interest. This idea was later warmly welcomed by Dr Child.

The author began his reply to the discussion by apologizing for the clumsy nomenclature used by the plastics chemists. He mentioned such simplifications as 'polythene' and 'nylon' but said that progress along these lines was slow. Accelerated tests were a snare and a delusion and he advised lighting engineers to have nothing to do with them. Polythene was the only material that could be improved by irradiation and the process had to be applied to the finished product. He discounted the possibility of a plastic spring, although certain plastics showed a considerable degree of springiness. The metals used for coating films were gold and others which would form a satisfactory bond with the material. With regard to acid attack he pointed out that p.v.c. cable covering contained a fairly high percentage of plasticizer and this might possibly be attacked. Polythene, he said, absorbed short-wave u.v., with consequent changes in its properties. For cleaning plastic fittings he recommended a detergent or simple soap and water; there were on the market certain materials which gave the surface a low resistivity and so reduced the trouble to static charges.

Conclusion

After the final paper the President, Mr H. G. Campbell, congratulated Mr Christopher and the Summer Meeting Committee on the organization of the Meeting and thanked all who had contributed to its success. Mr Christopher proposed a vote of thanks to the President and Mrs Campbell for the delightful way in which they had officiated throughout the Meeting which was warmly applauded.

REDUCTIONS IN PRICES of 'Atlantic' fittings are announced by Atlas Lighting Ltd, operative from June 15. Prices of individual fittings in the range have been reduced by up to 8 per cent. Some examples below show the new price with the amount of reduction in brackets. 18S/0080, 5 ft batten: £6 12*s.* (4*s.*); 18S/2080, 5 ft twin batten: £10 (12*s.*); 10S/0080, 5 ft ind. trough: £7 15*s.* (13*s.*); 14S/0080, 5 ft diffuser: £15 8*s.* 4*d.* (19*s.* 6*d.*).

These new prices also incorporate reductions made possible by recent purchase tax rulings, as shown above by the 14S diffuser fittings. Supplies of literature carrying the new prices are available from all Atlas area offices.

ALSO ANNOUNCING PRICE CUTS are Ekco-Ensign Electric Ltd, who state that, as from June 15, prices of their 'Essex' range of fluorescent fittings, together with certain other fittings and accessories, are being reduced, following lower production costs resulting from high level of sales. The trade is being circularized with new price lists.

THE FIRST ELECTRICAL FAIR, scheduled to be held from September 23 to October 1, 1960, at Alexandria Palace, has been deferred. The reason, say the organizers (Electrical Fairs Ltd, 6 Museum House, 25 Museum Street, W.C.1) is that most exhibitors would prefer a Central London venue. A further announcement is expected in the near future.

SINCE IES TECHNICAL REPORT NO. 1, 'Lighting in corrosive, flammable and explosive situations' was published, ammonia has been deleted from Group II of B.S.229: 1957, and the BSI states that Group I equipment may be used in an ammonia hazard. Readers having copies of the report may care to amend appendix 3 accordingly.

Situations

Vacant

TECHNICAL ASSISTANT (LIGHTING) required, capable of designing all classes of gas and electric lighting installations. Good technical groundwork in illuminating engineering and some experience in practical application. Technical qualifications an advantage. Commencing salary £875 rising to £948. Apply, giving details of experience, etc. (quoting reference 'LL'), to Chief Civil Engineer, British Railways, Southern Region, Waterloo Station, London, SE1.

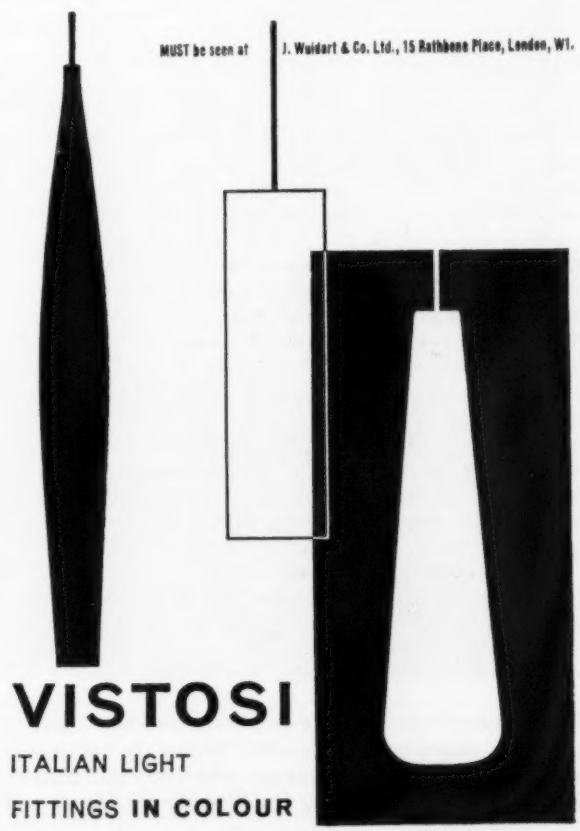
SENIOR LIGHTING ENGINEER required, with technical sales experience, for London and southern counties. The appointment is one of responsibility and carries an appropriate salary. The work is congenial and interesting. Car will be provided; preference will be given to applicant living within easy reach of N. London. Superannuation and life assurance scheme in operation. Holiday arrangements honoured. Replies should be addressed to Mr A. E. Wheeler, Simplex Electric Co Ltd, Wharf Estate, Ealing Road, Alperton, London, NW.

LIGHTING ENGINEER/DRAUGHTSMAN required by leading lighting fittings manufacturer. Capable of preparing interior lighting designs, estimates, surveys, etc. Age 22/28. Salary depending on age and experience. Write Box No. 714.

LIGHTING ENGINEERS with some experience in the planning of commercial, contemporary, display and industrial lighting installations are required by 'FALKS'. Age 24/35. Permanent, pensionable position. Scope for inside and outside work. There is also an opportunity in the 20/24 age group. Write stating qualifications, particular specialist experience, if any, age and salary required to Chief Engineer, 'A' Dept., Falk Stadelmann and Co Ltd, 91 Farringdon Road, London, E.C.1.

Wanted

LIGHTING ENGINEER, City and Guilds, Dip. MIES, with substantial sales contacts in north-west, desires change. Large experience industrial and commercial installations. Box No. 715.



Postscript

THERE HAVE BEEN SEVERAL ATTEMPTS in this country to secure an enactment which would enable statutory regulations to be made prescribing minimum standards of lighting in offices but, so far, without success. We have now been 'left at the post' by Eire, whose Ministers for Industry and Commerce and for Health have consulted together on this matter and have announced new office lighting regulations. Perhaps by the time we are able to emulate Eire in this respect office lighting practice will be generally so good that regulations will be redundant.

THE ELECTRICAL TIMES NEWS SHEET for the week of the recent IES summer meeting reported that comparison of lighting codes shows that the USSR prescribes generally higher illumination values than those recommended in the UK or USA codes. The writer of this note has not realized perhaps that the numbers in the Russian code refer to lux whereas those in the UK and USA codes refer, of course, to lumens per square foot alias foot-candles. In fact, the values in the USSR 'norms' do not go so high as those in either the UK or the USA codes. Misconception of this kind might be less likely if continental countries would state their values in dekalux—a device used by the author of one of the recent IES Harrogate papers. Unfortunately, the dekalux—which is equivalent to the rarely used milliphot—has yet to find acceptance in countries now accustomed to lux.

ONE OF THE DISCUSSIONS arranged at the IES Harrogate meeting dealt with the important subject of diagnosing 'situations' as a necessary preliminary to the prescription of proper lighting 'treatment'. The actual title of the discussion, 'Visual Task Analysis', tended to restrict the contributions to work situations although they did not stop there. Every potentially visible object or scene requires lighting only if it is to be made actually visible—that is, if it is to set a visual task. And the kind of lighting it should be given depends on whether it is to be made just visible or very easily visible and, in some cases, whether its appearance is to be made particularly pleasing. Although these are platitudes of which every lighting engineer must be aware, 'visual task' analysis is rarely practised methodically and in sufficient detail. Neither the amount of illumination nor the other conditions of lighting which will be most satisfactory can be prescribed with justifiable assurance for particular 'situations' until these situations have been diagnosed. Our present knowledge of the characteristics of numerous situations which are pertinent to their 'ideal' lighting is too imprecise. More and better 'task analysis' is needed. In the Harrogate discussion the work of E. S. Calvert on visual aids to landing aircraft in poor visibility was cited as an outstanding example of visual task analysis culminating in a highly successful lighting design. This work is described in Calvert's papers published in the IES Transactions.

FOR ME THE MOST PLEASURABLE EVENT of the Harrogate meeting was not any staged in the town itself. Neither the meetings—which were good—nor the banquet—which was enlivened by a most amusing letter read by His Worship the Mayor and which was graced by the presence of Miss Thompson, daughter of the first IES president. No; it was the spectacle of Fountains Abbey at night bathed in light of different colours. Never by day could the abbey ruins look like this although, situated as they are in beautiful natural surroundings, they are the centrepiece of a scene that should not be missed in daylight. Part of the arcadian setting of the abbey was itself beautified by the floodlighting which created novel and striking landscape contrasts. But, of course, the buildings themselves—fragmentary yet having a beauty to which their undesigned informality contributes—stood out as they never can by natural lighting. The colours were 'unnatural' but so, of course, was the whole scene; but it was an impressive work of art.

A SCENE REMINISCENT OF THAT SO frequently enacted at the famous Grotto of our Lady at Lourdes occurred last month in the caves at Chislehurst in Kent. Here in the main cavern, lighted by hundreds of candles, more than a thousand young people attended a service organized by the Rochester diocesan youth council. Anyone who has witnessed the scene at the Lourdes grotto will appreciate the mystic 'atmosphere' created by the multi-candle lighting of a rugged, irregular 'natural' interior. It is different from the eeriness engendered by the light of a single candle or lantern when exploring a cave. But, in choosing the venue for the Chislehurst service the organizers did not do so for 'effect'; the cavern just happened to be the only place in the district big enough to hold all the youngsters. During the bombing of London in the last world war it was the nightly refuge of many Londoners. The grotto at Lourdes is very much smaller but a vast underground church, capable of accommodating many thousands of pilgrims, was built two years ago; its illumination does not depend on candles.

THE CHELSEA STREET LAMP CASE which I mentioned last month has been lost by the plaintiff, but the controversy goes on. 'Peterborough' of *The Daily Telegraph*—who more than once has criticized new streetlighting 'furniture' in old neighbourhoods—is one of those who disapprove of Chelsea council's choice of Group B streetlighting units. The June number of the *Architectural Review* contains an article which is also strongly critical of the Chelsea scheme, and especially of the 15-ft mounting height of the lanterns. It is true, of course, that this height corresponds pretty well with that of the centre of first floor windows in a majority of dwellings—whether situated in Chelsea or elsewhere. Is there a case for going from the old 12-ft height to 20 ft? It appears that in the matter of column colour the Chelsea council is offering residents a choice of nearly twenty finishes and is inviting them to notify the borough engineer of their preferences. Presumably the choice of the majority will prevail but some residents appear to think this is a trivial aspect of a streetlighting installation as compared with mounting height.

'Lumeritas'

this is the story . .

of a new light in Edinburgh's surgical neurology theatre

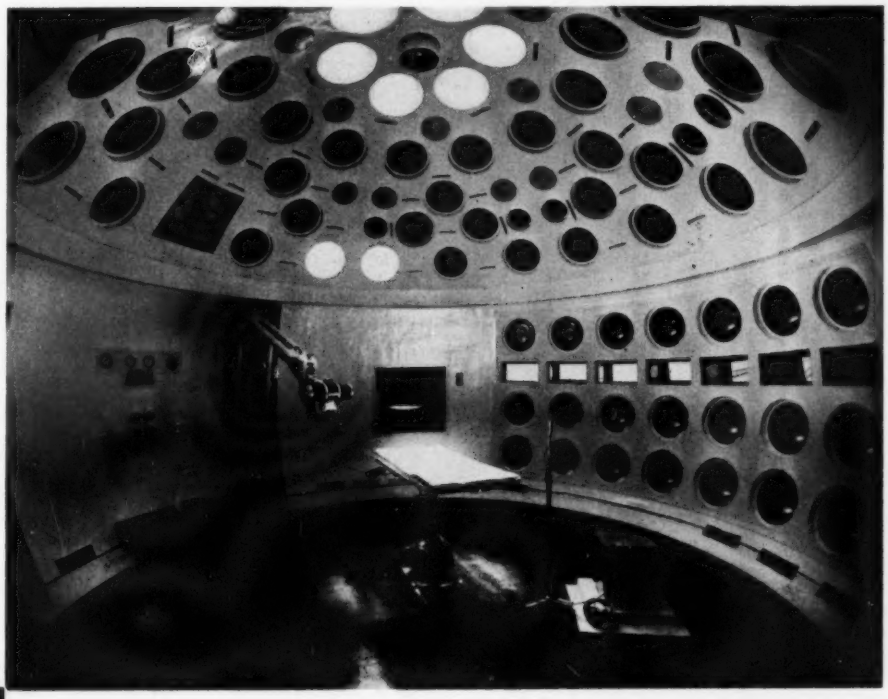
Newly developed G.E.C. magnetic switch controllers, the first of their kind in the world—shown here in an outline drawing—control all lighting in the two new operating theatres of the Western General Hospital in Edinburgh. Of unusual, almost ovoid shape, these theatres are equipped with the most modern apparatus to assist the work of the eminent brain surgeon and his staff.

Each theatre has 18 lights for general illumination and 68 adjustable operation projector lights specially designed and made by the G.E.C., using special silvered Osram 75W small filament lamps.

The new and patented magnetic switch controller is designed for simplicity and safety in operation. Briefly, it consists of magnetic switches located behind a metal panel on which is outlined the shape of the ceiling and wall lights, as shown.

The lights can be quickly and easily directed during operations by simply moving metal plates across the panel which switch on groups of lights corresponding to the pattern of the plates. Usually 12 lights are in use at a time providing over 2,000 lm/ft² at the focal point on the table. All electrical maintenance and lamp replacement is effected from outside the theatre.

Britain's leading lighting designers are proud to add this installation to their outstanding record of achievements.



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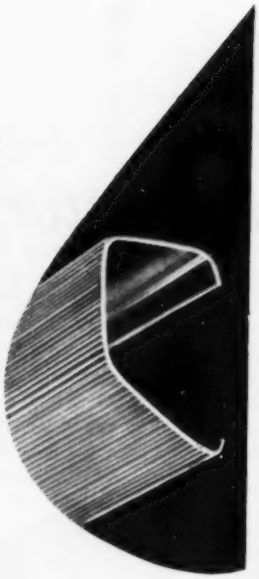

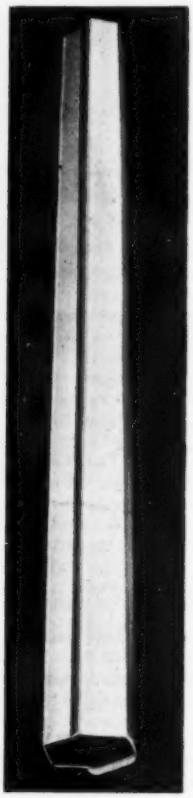

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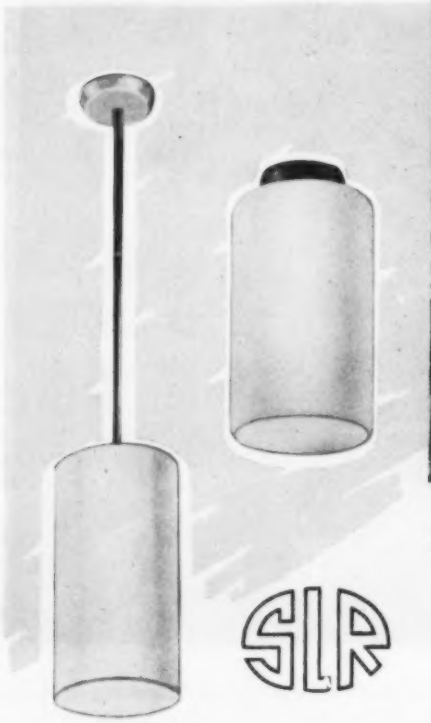

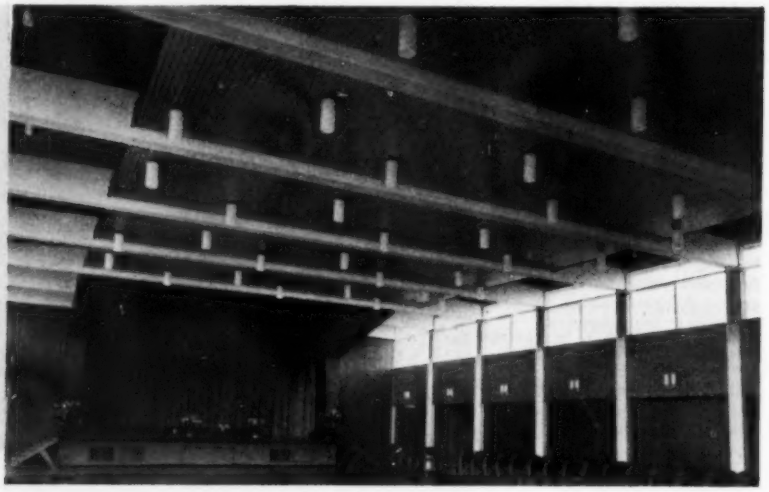

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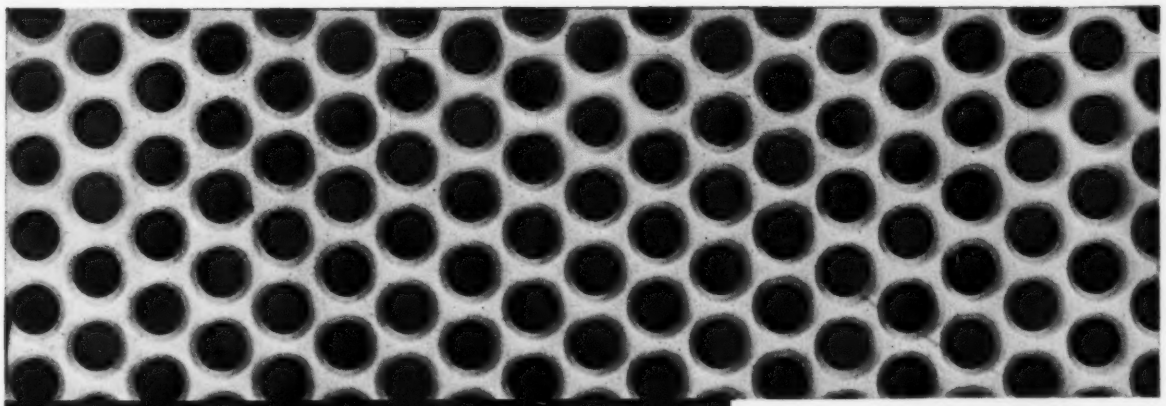

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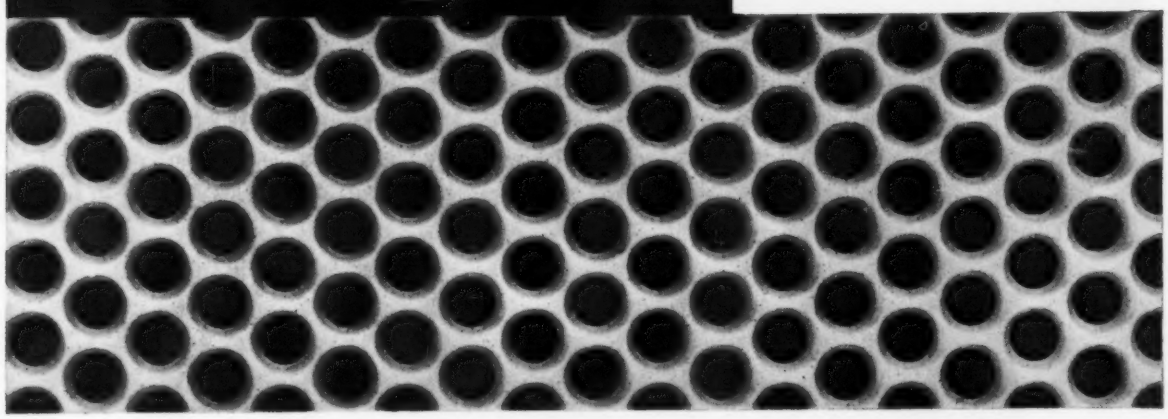

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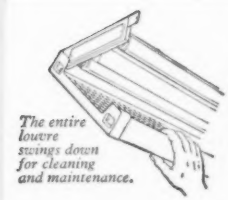

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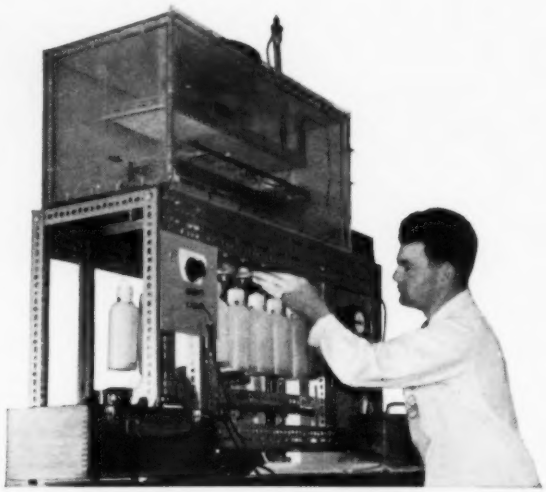

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